Repair Manual
Jetta 2011 ➤

Generic Scan Tool									
Engine ID	CBP A								

Edition 10.2014

List of Workshop Manual Repair Groups

Repair Group

ST - Generic Scan Tool

Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

Contents

ST – Generic Scan Tool

1 General Information

(Edition 10.2014)

Included in the contents of this Generic Scan Tool (GST) manual is a summary table of the vehicle specific OBD II Emission Related DTCs. The DTC table contains DTC Malfunction Criteria, Threshold Values, Secondary Parameters, Enabling Conditions, Monitoring Time Length, Frequency of Checks, and MIL Illumination information which can be used to accurately monitor and diagnose emissions related faults and perform functions required to run Modes 01 through 09 with a hand held scan tool. For a further description of specific monitor information, an OBD strategy document is referenced throughout this manual.

This manual also contains the step by step procedures to accurately diagnose and repair a component or system once a DTC has been set. References to repair procedures and wiring diagrams can be found within the diagnostic test procedures.

1.1 Safety Precautions

Check for Technical Bulletins that may supersede any information included in this manual.

WARNING

Failure to follow these instructions may result in personal injury or possible death.

Check the Technical Bulletins for information, cautions and warnings that may supersede or supplement any information included in this manual.

When performing the drive cycle operation, pay strict attention to driving conditions and observe and obey all posted speed limits.

Test equipment must always be secured to the rear seat and operated by a second person. If test and measuring equipment is operated from the passenger seat, the person seated could be injured in the event of an accident involving deployment of the passenger-side airbag.

The fuel system is under pressure!

Direct Injection engines use a High Pressure fuel pump driven by the engine camshaft and the pump, fuel lines, rails and injectors are under Extremely High Pressure. Refer to the Repair manual for releasing pressure or before opening the fuel system for diagnosis or repair.

When working on engine or conventional fuel injection system, fuel pressure must be relieved to residual pressure before opening high pressure components. Refer to the Repair Manual for the proper procedure.

If the battery has not been disconnected, the fuel pump fuse must be removed before opening the fuel supply system as the fuel pump may be activated by the driver's door contact switch.

Testing of the EVAP and ORVR systems can result in the escape of explosive fuel vapor. Do not smoke while testing the EVAP system, and make sure the area you are working in is well ventilated.

Observe the following for all procedures, especially in the engine compartment due to lack of room:

- *Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.*
- *Watch for sufficient clearance to all moving or hot components.*
- *Do not touch or disconnect the Ignition Coils, ignition wires, connecting parts or adapter cables when the ignition is on or the engine is running or turning at starting RPM.*

- *Only disconnect and reconnect wires for injection and ignition system, including test leads, when the ignition is turned off.*

When removing and installing components from full or partially full fuel tanks, observe the following:

- *The fuel tank must only be partially full. How much fuel can remain in the fuel tank may be read in the respective work description. Empty the fuel tank if necessary.*
- *Before starting work, switch on the exhaust extraction system and place an extraction hose close to the installation opening of the fuel tank to extract escaping fuel fumes. If no exhaust extraction system is available, a radial fan (as long as motor is not in air flow) with a displacement greater than 15 m^3/h can be used.*
- *Prevent fuel from contacting the skin. Wear fuel-resistant gloves!*

When servicing the engine control module (ECM), it may be necessary to use a heat gun. The heat gun, shear bolts, and parts of the protective housing will become extremely hot. Use extreme caution when working with or handling these parts to avoid personal injury.

Observe operating instructions when working with a heat gun. To prevent damage (burning) to the wiring and harness connections, insulation and the electronic components, perform outlined work steps exactly!

The cooling system is under pressure. To avoid scalding, use caution when opening the cooling system and servicing cooling system components!

Caution

The battery must only be disconnected and connected with the ignition switched off. Otherwise, the engine control module (ECM) can be damaged.

The use of nails, paper clips, or another unauthorized materials to back-probe electrical harness connectors is strictly prohibited and may cause damage to the electrical harness connectors, terminal ends or to a component. Use only the manufacturers test lead kit or an equivalent aftermarket test lead kit for back-probing all electrical harness connectors.

Do not use sealants containing silicone. Particles of silicone drawn into the engine, will not be burnt in the engine and will damage the oxygen sensors.

Secure all hose connections with the correct hose clips (the same as original equipment).

If engine is to be cranked without starting, for example as part of a compression test, remove the fuses for the voltage supply of Ignition Coils and the fuel injector.

An electrostatic charge can lead to functional problems of electrical components of the engine, transmission and selector lever mechanism. Touch a grounded object, e.g. a water pipe or a hoist, before working on electrical components.

Do not make direct contact with electrical harness connector terminals.

Use only gold-plated terminals when servicing any component with gold-plated electrical harness connector terminals.

1.2 Clean Working Conditions

Even minor contaminations can lead to malfunctions in the fuel injection system. When working on the fuel supply/injection system, pay careful attention to the following rules of cleanliness:

- Thoroughly clean all connections and the surrounding area before disconnecting.
- Place removed parts on a clean surface and cover. Use lint-free cloths.
- Carefully cover over opened components or seal, if repairs are not performed immediately.
- When the system is open, do not work with compressed air. Do not move vehicle unless absolutely necessary.
- Install clean components: Remove replacement parts immediately prior to installation. Do not use parts that have been stored unpacked (e.g. in tool boxes etc.).
- Separated electrical connectors: Protect from dirt and moisture. Make sure connections are dry when reconnecting.

1.3 On Board Diagnostic Systems

California OBD-II applies to all gasoline engine vehicles up to 14,000 lbs. Gross Vehicle Weight Rating (GVWR) starting in the 1996 MY and all diesel engine vehicles up to 14,000 lbs. GVWR starting in the 1997 MY.

Several states in the northeastern United States have chosen to adopt the California emission regulations starting in the 1998 MY and are known as "Green States".

Green States receive California-certified vehicles for passenger cars and light trucks up to 6,000 lbs. GVWR. Starting in the 2004 MY, Federal vehicle over 8,500 lbs. will start phasing in OBD-II.

Starting in 2004 MY, gasoline-fueled medium duty passenger vehicles are required to have OBD-II. Federal OBD-II applies to all gasoline engine vehicles up to 8,500 lbs. GVWR starting in the 1996 MY and all diesel engine vehicles up to 8,500 lbs. GVWR starting in the 1997 MY.

OBD-II system implementation and operation is described in the remainder of this document.

1.4 Malfunction Indicator Lamp Illumination

If the engine control module (ECM) recognizes a malfunction that leads to increased emission values, it indicates them by illuminating the malfunction indicator lamp (MIL) which is located in the instrument cluster.

The ECM commands on the MIL after the ignition is switched on. Shortly after the engine is started, the MIL goes out if the ECM does not detect a malfunction that increases the emission values.

If the ECM recognizes a malfunction that leads to increased emissions during the operation of the engine, the ECM commands the MIL on and an entry is stored in the DTC memory of the ECM.

1.5 Controller Area Network Data Link

The engine control module (ECM) communicates with data bus capable control modules via a CAN Data Link.

The data bus capable control modules are connected via data bus wires, which are twisted together (CAN high and CAN low), and exchange information with the ECM. Missing or implausible information on the data bus is recognized and stored as a malfunction based on specific DTC criteria.

The malfunction indicator lamp (MIL) is illuminated as a result of a CAN message sent by the ECM. The MIL can be turned on, turned off, or blink, depending on the command received from the ECM.

1.6 Electronic Power Control Warning Lamp

The engine control module (ECM) monitors electronic power control (EPC) components when the ignition is switched on.

If a malfunction is recognized in the EPC system, the ECM switches on the EPC warning lamp, which is located in the instrument cluster, and an entry is stored in the DTC memory of the ECM.

2 Description and Operation

Check for technical bulletins that may supersede any information included in this manual.

Observe all safety precautions:
⇒ “1.1 Safety Precautions”, page 2

View clean working conditions:
⇒ “1.2 Clean Working Conditions”, page 4

Note

- *All manufacturers special tools as well as common tools may contain a manufacturer specific part number. These tools may be substituted with an equivalent aftermarket tool or are available for purchase through the manufacturer.*
- *Manufacturers special tools as well as common tools that contain a manufacturer specific part number may be referenced in the test procedure illustrations showing the tool use or installation. If the manufacturer specific tool is not being used, an equivalent aftermarket tool may be installed in the same manner as the manufacturers special tool.*

2.1 Fuel Supply System

For all fuel supply system component locations, removal/installation procedures and torque specifications, refer to the Repair Manual.

2.2 Evaporative Emission System

The evaporative emission system has been designed to minimize the release of hydrocarbons from the fuel system into the atmosphere. The evaporative system components all work together with the ECM to prevent fuel vapor from escaping and route it to the intake manifold to be burned during normal combustion.

The leak detection system checks the integrity of the evaporative emission system by pressurizing system.

- When leak detection is activated, a pump pressurizes the evaporative system.
- During the leak diagnosis, the system is monitored for a specific time period. If the pressure does not drop a specific amount during the time period, the system is considered to be sealed.
- If the pressure drops greater than a specified amount during a specific time period, the system is pressurized once more. The engine control module measures the time until the pressure drops again. The control module uses the measured value to determine the size of the leak.

Leak diagnosis is activated automatically shortly following every engine start. If a malfunction is determined, an entry is made to the DTC memory. The Malfunction Indicator Lamp in the instrument cluster is illuminated if the malfunction is recognized for two subsequent starts.

For all evaporative system component locations, hose routing, removal/installation procedures and torque specifications, refer to the Repair Manual.

2.3 Electronic Engine Power Control

With an EPC system, the throttle valve is not operated by a cable from the accelerator pedal. There is no mechanical connection between the accelerator pedal and the throttle valve.

The position of the accelerator pedal is communicated to engine control module (ECM) by the throttle position sensor / accelerator pedal position sensor 2 (variable resistances; stored in one housing) that are mounted on the accelerator pedal assembly.

The accelerator pedal position (drivers' intention) is a main input unit for the ECM.

Operation of the throttle valve occurs via an electric motor, the throttle drive for in the throttle valve control module. This is true across the entire engine speed and engine load spectrum.

The throttle valve is operated by the EPC according to commands from the engine control module (ECM).

With engine off and ignition switched on, the ECM controls the throttle drive according to input from the throttle position sensor / accelerator pedal position sensor 2. This means, engine load, speed or other sensor inputs are not a contributing factor. If the accelerator pedal is pressed half way, the throttle drive opens the throttle valve to the same degree; i.e. throttle valve is then opened approximately half way.

With engine running under load, ECM can open or close the throttle valve independently of the throttle position sensor / accelerator pedal position sensor 2 based on other sensors or contributing factors.

This means, for example, that under certain conditions the throttle valve could be opened above half throttle even though the accelerator pedal has only been pressed half way. This has the advantage of preventing torque losses from the throttle valve position while under load.

In addition, it can result in a significant reduction in emissions and fuel consumption under lighter engine load conditions.

EPC is an acronym for the system containing all components that contribute to recognizing, actuating and monitoring the position of the throttle valve.

2.4 Fuel Injection System

For all fuel injection system component locations, removal/installation procedures and torque specifications, refer to the Repair Manual.

2.5 Engine Control Module

The ECM regulates fuel injection, throttle valve control module, oxygen sensor regulation, ignition, knock control, evaporative emission purge valve, engine speed limitation through the fuel injectors or the power supply relay, as well as OBD functions.

2.6 Exhaust System Components

For all exhaust system, emission control component locations, removal/installation procedures and torque specifications, refer to the Repair Manual.

2.7 Ignition System

For all ignition system component locations, removal/installation procedures and torque specifications, refer to the Repair Manual.

2.8 Automatic Transmission

The Transmission Control Module receives information from transmission related components and engine sensors. The TCM uses this information to control shifting and other operations of the automatic transmission.

For all automatic transmission component locations, removal/installation procedures and torque specifications, refer to the Repair Manual.

3 Diagnosis and Testing

3.1 Preliminary Check

Prior to component diagnosis, a preliminary check must be performed.

Check the technical bulletins for information that may supersede any information included in this manual.

– Connect the scan tool.

– Switch the ignition ON.

– Using the scan tool, check for any stored or related DTCs.

If other DTCs are stored:

– Repair those DTCs first before performing the following procedure.

If no other DTCs are stored:

– Using the scan tool, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 16 .

– Perform a road test to attempt to duplicate the customers complaint.

If the DTC returns:

– Perform the diagnostic procedure.

If the DTC does not return:

– The fault is intermittent or a sporadic condition may exist.

– Check the suspected component, electrical harness and electrical harness connectors for damage, corrosion, loose or broken terminals.

– If necessary, repair the faulty wiring connection.

– Perform a road test to verify the repair.

If the DTC returns:

– Perform the diagnostic procedure.

If the DTC does not return:

The fault may have been the result of a loose electrical connection.

– Generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 9 .

3.2 Readiness Code

Readiness code description

Diagnostics are performed at regular intervals during normal vehicle operation. After repairing an emissions related system, a readiness code is generated by road testing the vehicle.

If a malfunction is recognized during the drive cycle, it will be stored in the DTC memory.

The OBD drive cycle operation will be monitored with a hand held diagnostic tool. Consult the manufacturer's instruction manual for correct tool operation.

The readiness code is erased every time the DTC memory is erased or any time the battery is disconnected. If the DTC memory has been erased or the battery is disconnected, a new readiness code must be generated.

Only erase the DTC memory if a DTC has been stored.

General recommendations

Most monitors will complete sooner using a “steady-foot” and “smooth” acceleration movements during the drive cycle operation, cruise, and acceleration modes. Quick throttle changes will result in extended time required for monitors to complete a readiness code.

Operating conditions

For the EVAP monitor test, the coolant temperature and the ambient air temperature must be between 10° C and 35° C with a difference between them no greater than 4° C. The ambient air temperature must not change more than 4° C during the drive cycle procedure (e.g. when driving out of a heated workshop in the winter).

Test requirements

- Erase the DTC memory.
- Coolant temperature must be between 80° C and 110° C.
- The intake air temperature must be between 10° C and 35° C.
- Battery voltage must be a minimum of 12.5 volts.
- Fuel tank level 1/4 to 3/4 full.

Drive Cycle Procedure

– Connect the scan tool.

– Start the vehicle.

– Idle the vehicle for 2-3 minutes. This executes the O2 heater, misfire, secondary air injection, fuel trim, and purge system monitors.

– Drive the vehicle at 45-55 mph for a continuous 7 minute period - avoid stopping. This executes the evaporative, O2 sensor, fuel trim, and misfire monitors.

– Accelerate the vehicle to an engine speed of 5000 RPM; lift off the throttle until the engine speed is around 1200 rpm. This executes the fuel cut off.

– Accelerate the vehicle smoothly to 60-65 mph, cruise constantly for 5 min, this executes the catalyst; O2 sensor, misfire, fuel trim, and purge system monitors.

– Decelerate and idle the vehicle again for 3 minutes. This executes the misfire, secondary sir injection, fuel trim, and purge system monitors.

– Check the status of the readiness code.

Note

Depending on the scan tool used. The readiness code status may be displayed as complete, passed or OK.

– If any engine monitor fails to set a readiness code pass, the drive cycle test should be repeated.

Note

When repeating the drive cycle operation for a failed evaporative or thermostat monitor, allow the engine to cool until the coolant temperature and the ambient air temperature are be between 10° C and 35° C with a difference no greater than 4° C and repeat the drive cycle operation.

If the drive cycle operation fails again.

– Check the DTC memory for stored DTCs.

Repair the vehicle if necessary.

– Repeat the drive cycle operation until all engine monitors have successfully run through and passed.

– Remove the scan tool and switch the ignition off.

3.3 Diagnostic Modes 01 - 09

The information provided in Modes 01 through 09 displays the various levels of emission related data that may be monitored, as well as the ability to retrieve and read stored DTC trouble codes, erase stored DTC trouble codes, generate readiness codes, and select the various PIDs and Test-IDs used within the modes to monitor the engine, and emission related component parameters.

Note

Depending on scan tool and protocol used, the information in diagnostic mode 01 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), or On-Board Diagnostic Monitor Identifier (OBDMID).

⇒ “3.3.1 Diagnostic Mode 01 - Read Current System Data”, page 12

⇒ “3.3.2 Diagnostic Mode 02 - Read Operating Conditions”, page 13

⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14

⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 16

⇒ “3.3.5 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions 2011 - 2014”, page 17

⇒ “3.3.6 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions 2015”, page 24

⇒ “3.3.7 Diagnostic Mode 07 - Read Faults Detected During the Current or Last Driving Cycle”, page 31

⇒ “3.3.8 Diagnostic Mode 08 - Request Control of On-Board System, Test or Component”, page 31

⇒ “3.3.9 Diagnostic Mode 09 - Read Vehicle Information”, page 31

3.3.1 Diagnostic Mode 01 - Read Current System Data

Diagnostic Mode 01 makes it possible to access current emissions-related measured values and diagnostic data. The original measured values (no replacement values), input and output data and system status information are displayed using Diagnostic Mode 1.

Test requirement

- Coolant temperature at least 80 °C.

Procedure

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 1: Obtain data.”.

– From the following table, select the desired the “PID” that is to be monitored, e.g. “PID $05 Coolant temperature”.

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
$01:	Monitoring status since erasing DTC memory
$03:	Status of fuel system bank 1 and 2
$04:	Calculated load value
$05:	Coolant temperature
$06:	Short term fuel trim bank 1
$07:	Long term fuel trim bank 1
$0B:	Intake manifold absolute pressure (MAP)
$0C:	Engine RPM
$0D:	Vehicle speed sensor
$0E:	Ignition timing advance for # 1 cylinder
$0F:	Intake air temperature
$11:	Absolute throttle position
$13:	Oxygen Sensor Bank 1 Sensor 1
$15:	Oxygen Sensor Bank 1 Sensor 2

PID	Component or System
$1C:	OBD requirements to engine certification
$1F:	Time since engine start
$21:	Distance driven with MIL ON
$2E:	Commanded evap purge
$30:	Warm up counts after DTC erased
$31:	Distance driven after erasing DTC memory
$33:	Barometric pressure
$34:	Heater current Bank 1 Sensor 1
$3C:	Calculated catalyst temperature
$41:	Monitor status current drive cycle
$42:	Control module voltage
$43:	Absolute load value
$44:	Specified value of oxygen sensor signal
$45:	Relative throttle valve position
$46:	Ambient temperature
$47:	Absolute throttle position B
$49:	Accelerator pedal position D
$4A:	Accelerator pedal position E
$4C:	Commanded throttle actuator control
$56:	Long term secondary O2 sensor Fuel Trim Bank 1

– Switch the ignition OFF.

3.3.2 Diagnostic Mode 02 - Read Operating Conditions

When an emissions-related fault (pending DTC, visible in mode 07) is first detected, operating conditions are stored. Mode 02 makes it possible to access this freeze frame data as soon as this fault is shown in mode 03. Each control module only shows freeze frame data for one fault via mode 02. Therefore, there are two priority levels. If there is a malfunction with higher priority, the freeze frame data is overwritten.

– Fault with higher priority: Misfire malfunction or fuel trim malfunction.

– Fault with normal priority: All other emissions-related faults.

Note

Depending on scan tool and protocol used, the information in diagnostic mode 02 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), or On-Board Diagnostic Monitor Identifier (OBDMID).

Procedure

– Connect the scan tool.

– Start the engine and run at idle.

Note

If the engine does not start, crank the engine using starter for at least 5 seconds, do not switch the ignition off afterward.

– Select “Diagnostic Mode 2: Obtain operating conditions.”.

– From the following table, select the desired the “PID”, e.g. “PID $05 Coolant temperature” that is to be monitored.

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
$02:	DTC which triggered Freeze Frame data
$03:	Fuel system status
$04:	Calculated load value
$05:	Engine coolant temperature
$06:	Short term fuel trim bank 1
$07:	Long term fuel trim bank 1
$0B:	Intake manifold absolute pressure (MAP)
$0C:	Engine RPM
$0D:	Vehicle speed
$0E:	Ignition timing advance for # 1 cylinder
$0F:	Intake air temperature
$11:	absolute throttle position
$1F:	Time since engine start
$2E:	Commanded EVAP purge
$33:	Barometric pressure
$42:	Control module voltage
$43:	Absolute load value
$44:	Air/Fuel Commanded equivalence ratio
$45:	Relative throttle valve position
$46:	Ambient temperature
$47:	Absolute throttle position B
$49:	Accelerator pedal position D
$4A:	Accelerator pedal position E
$4C:	Commanded throttle actuator control
$56:	Long term secondary O2 sensor fuel trim bank 1

– Switch the ignition OFF.

3.3.3 Diagnostic Mode 03 - Read DTC Memory

Diagnostic Mode 03 makes it possible to read emissions-related faults (confirmed DTCs: faults which have activated the MIL) in the ECM and in the TCM.

When the ECM recognizes an emission related fault it turns on the malfunction indicator lamp. If an electronic throttle malfunction is recognized, the ECM turns on the electronic power control warning lamp. Both are located in the instrument cluster.

The DTCs are sorted by SAE code with the DTC tables consisting of a 5 digit alpha numeric value.

Note

Depending on scan tool and protocol used, diagnostic mode 03 and the information provided may be referred to by a different name.

The following tables provide a breakdown and explanation of the DTC code.

P-Codes

Component group					
P	x	x	x	x	DTC for the drivetrain
Norm-Code					
P	0	x	x	x	Trouble codes defined by SAE with specified malfunction texts
P	1	x	x	x	Additional emission relevant DTCs provided by the manufacturer
P	2	x	x	x	DTCs defined by SAE with specified texts, from MY 2000
P	3	x	x	x	Additional emission relevant DTCs provided by the manufacturer from MY 2000

Component group					
Repair group					
P	x	0	x	x	Fuel and air mixture and additional emission regulations
P	x	1	x	x	Fuel and air ratios
P	x	2	x	x	Fuel and air ratios
P	x	3	x	x	Ignition system
P	x	4	x	x	Additional exhaust system
P	x	5	x	x	Speed and idle control
P	x	6	x	x	Control module and output signals
P	x	7	x	x	Transmission
P	x	8	x	x	Transmission
P	x	9	x	x	Control modules, input and output signals

U-Codes

Component group					
U	x	x	x	x	DTC for network (CAN bus)
Norm-Code					
U	0	x	x	x	Trouble codes defined by SAE with specified malfunction texts

Procedure

– Connect the scan tool.

– Switch the ignition to the ON position.

– Select Diagnostic Mode 03: Interrogating fault memory.

– The stored DTC or DTCs will be displayed on the scan tool screen.

The following table is an example of the DTC information that may be displayed on the scan tool screen:

Indication example	Explanation
P0444	SAE Diagnostic Trouble Code
Evaporative emission canister purge regulator valve	Malfunctioning wiring path or malfunctioning component
Circuit open	Malfunction type as next

– Refer to the DTC tables for the diagnostic repair procedures.

– Switch the ignition OFF.

3.3.4 Diagnostic Mode 04 - Erase DTC Memory

Diagnostic Mode 04 makes it possible to erase the DTC memory and to reset all emissions-related diagnostic data. In that way, all faults in the DTC memory in the ECM and TCM are erased. The adaptation values may also be reset.

Emissions-related diagnostic data includes (as applicable):

- - MIL Status
- - Number of DTCs
- - Readiness bits
- - Confirmed DTCs
- - Pending DTCs
- - DTC that belongs to freeze frame
- - Freeze frame data
- - Test results of specific diagnostic functions
- - Distance driven with “MIL ON”
- - Number of warm-up cycles after erasing the DTC memory
- - Distance driven after erasing the DTC memory
- - Misfire counter

Note

Depending on scan tool and protocol used, diagnostic mode 04 and the information provided may be referred to by a different name.

Procedure

– Connect the scan tool.

– Switch the ignition on.

– Select Diagnostic Mode 03: Interrogating fault memory.

– Then select Mode 4: Reset/delete diagnostic data.

The scan tool will display: Diagnostic data are being erased.

– Switch the ignition OFF.

3.3.5 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions 2011 - 2014

Diagnostic Mode 06 makes it possible to retrieve test results for special components and systems which are continuously or not continuously monitored. If the diagnosis of a system is complete, the diagnostic result and the corresponding thresholds are saved and displayed in mode 06. This data remains saved (even with the ignition off) until either new diagnostic results become available or the DTC memory is erased.

The min & max values for each individual test in Mode 06 represent the minimum & maximum operating values for a properly operating system. This data is provided to the individual aftermarket scan tool companies for development of their scan tool. Depending on the scan tool being used, the min & max values shown may vary, or be rounded up or down to the nearest decimal point depending on the aftermarket scan tool company's development process. e.g.:

	Minimum Value
GST manual documentation	0.3499
Aftermarket scan tool display	0.35

Note

Depending on the scan tool and protocol used, the information displayed in diagnostic mode 06 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), or On-Board Diagnostic Monitor Identifier (OBDMID).

Test requirements

- Exhaust system must be properly sealed between the catalytic converter and the cylinder heads.
- No DTCs stored in the DTC memory.
- Coolant temperature at least 80 °C.

Work procedure

– Connect the scan tool.

– Start the engine and let run at idle speed.

– Select Mode 6: Check test the results of components that are not continuously monitored.

Select the desired Test-ID..

The current minimum and maximum values will be displayed on the scan tool screen.

The following table is a numerical list of all“Test-IDs” that may be selected.

Monitor-ID	Component or System
$01: ⇒ page 18	Oxygen Sensor Monitor Bank 1 - Sensor 1
$02: ⇒ page 18	Oxygen Sensor Monitor Bank 1 - Sensor 2
$21: ⇒ page 19	Catalytic Converter Monitoring
$3B: ⇒ page 19	Fuel Tank EVAP System Integrity/Leak Test (0.40/1.0 mm)
$3C: ⇒ page 20	Fuel Tank EVAP System Integrity/Leak Test (0.20/0.5 mm)

Monitor-ID	Component or System
$3D: ⇒ page 20	EVAP Purge Valve Function Check
$41: ⇒ page 21	Oxygen Sensor Heater Monitor Bank 1 - Sensor 1
$42: ⇒ page 21	Oxygen Sensor Heater Monitor Bank 1 - Sensor 2
$A2: ⇒ page 22	Mis-Fire Cylinder 1 Data
$A3: ⇒ page 22	Mis-Fire Cylinder 2 Data
$A4: ⇒ page 23	Mis-Fire Cylinder 3 Data
$A5: ⇒ page 23	Mis-Fire Cylinder 4 Data

Monitor-ID $01: Oxygen Sensor Monitor Bank 1 - Sensor 1

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID $01”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$83	P0133	O2 signal dynamic Bank 1 Sensor 1	0.250 V	1.999 V	Refer to DTC P0133 in the DTC summary table. ⇒ page 40 .
$84	P2195 P2196	O2 sensor front/rear rationality Bank 1 Sensor 1	-0.070 V	0.070 V	Refer to DTC P2195 in the DTC summary table. ⇒ page 67 Refer to DTC P2195 in the DTC summary table. ⇒ page 67
$89	P0133	O2 signal dynamic Bank 1 Sensor 1	0.250 V	1.999 V	Refer to DTC P0133 in the DTC summary table. ⇒ page 40 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $02: Oxygen Sensor Monitor Bank 1- Sensor 2

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID $02”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$05	P013A	Deceleration test - O2 transient time rich to lean Bank 1 Sensor 2.	0 s	0.500 s	Refer to DTC P013A in the DTC summary table. ⇒ page 42
$8A	P2271	Minimum oxygen sensor voltage Bank 1 Sensor 2.	0 V	.1495 V	Refer to DTC P2271 in the DTC summary table. ⇒ page 69
$81	P2271	Minimum sensor voltage of oscillation Bank 1 Sensor 2.	0.00 V	0.8018 V	Refer to DTC P2271 in the DTC summary table. ⇒ page 69
$82	P2270	Maximum sensor voltage of oscillation Bank 1 Sensor 2.	0.5980 V	1.1306 V	Refer to DTC P2270 in the DTC summary table. ⇒ page 68

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .
– Switch the ignition OFF.

Monitor-ID $21: Catalytic Converter Monitoring

– Connect the scan tool.
– Start the engine and run at idle.
– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 21”.

– Select the desired “Test-ID” .
– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$84	P0420	Catalyst quality compared to borderline catalyst bank 1.	1 or (2012> MY 100%)	19.988 or (2012> MY 655.35 %)	Refer to DTC P0420 in the DTC summary table. ⇒ page 50 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .
– Switch the ignition OFF.

Monitor-ID $3B: Fuel Tank EVAP System Integrity/Leak Test (0.40/1.0mm)

– Connect the scan tool.
– Start the engine and run at idle.
– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 3B”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$86	P0442	Fuel Tank Leak Test: Small leak	7373 or (2012> MY 900.0 Pa)	65535 or (2012> MY 8191.75 Pa)	Refer to DTC P0442 the DTC summary table. ⇒ page 56

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $3C: Fuel Tank EVAP System Integrity/Leak Test (0.20/0.5mm)

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 3C”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$84	P0456	Fuel Tank Leak Test, very small leak.	0.00	0.170	Refer to DTC P0456 in the DTC summary table. ⇒ page 57 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $3D: EVAP Valve Function Check

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 3D”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$8C	P0496	Purge flow monitor valve open.	0.00000000 mA	[5.10000000..18.80000000] mA	Refer to DTC P0496 in the DTC summary table. ⇒ page 58
$8D	P0441	Purge flow monitor valve closed.	0.00000000 mA	[3.30000000..36.30000000] mA	Refer to DTC P0441 in the DTC summary table. ⇒ page 55 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $41: Oxygen Sensor Heater Monitor Bank 1 - Sensor 1

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 41”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$85	P0135	Oxygen sensor heating in front of catalytic converter, diagnosis, Bank 1 Sensor 1 Ceramic temperature monitoring.	715° C	6513.5° C	Refer to DTC P0135 in the DTC summary table. ⇒ page 40 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $42: Oxygen Sensor Heater Monitor Bank 1 - Sensor 2

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 42”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$81	P0141	Oxygen sensor circuit diagnosis, Bank 1 Sensor 2 internal resistance test.	0.00 Ω	32.400k Ω	Refer to DTC P0141 in the DTC summary table. ⇒ page 43 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .
– Switch the ignition OFF.

Monitor-ID $A2: Mis-Fire Cylinder 1 Data

– Connect the scan tool.
– Start the engine and run at idle.
– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID A2”.

– Select the desired “Test-ID” .
– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0301	Misfire cylinder 1, Average value over 10 Driving Cycles.	0 - 65535 (counts)	Refer to DTC P0301 in the DTC summary table. ⇒ page 46 .
$0C	P0301	Misfire cylinder 1, in this Driving Cycle.	0 - 65535 (counts)	Refer to DTC P0301 in the DTC summary table. ⇒ page 46 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .
– Switch the ignition OFF.

Monitor-ID $A3: Mis-Fire Cylinder 2 Data

– Connect the scan tool.
– Start the engine and run at idle.
– Select “Mode 6 Check test the results of components that are not continuously monitored”.

Select “Monitor-ID A3:”.

– Select the desired “Test-ID” .
– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0302	Misfire cylinder 2, Average value over 10 Driving Cycles.	0 - 65535 (counts)	Refer to DTC P0302 in the DTC summary table. ⇒ page 47 .

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0C	P0302	Misfire cylinder 2, in this Driving Cycle.	0 - 65535 (counts)	Refer to DTC P0302 in the DTC summary table. ⇒ page 47 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $A4: Mis-Fire Cylinder 3 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID A4”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0303	Misfire cylinder 3, Average value over 10 Driving Cycles.	0 - 65535 (counts)	Refer to DTC P0303 in the DTC summary table. ⇒ page 47 .
$0C	P0303	Misfire cylinder 3, in this Driving Cycle.	0 - 65535 (counts)	Refer to DTC P0303 in the DTC summary table. ⇒ page 47 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $A5: Mis-Fire Cylinder 4 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID A5”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0304	Misfire cylinder 4, Average value over 10 Driving Cycles.	0 - 65535 (counts)	Refer to DTC P0304 in the DTC summary table. ⇒ page 48 .

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0C	P0304	Misfire cylinder 4, in this Driving Cycle. .	0 - 65535 (counts)	Refer to DTC P0304 in the DTC summary table. ⇒ page 48 .

– Switch the ignition OFF.

– If any of the components or systems fail to meet the specified values, refer to Diagnostic Mode 03: Interrogating Fault Memory to check for stored DTCs or the corresponding diagnostic repair procedure.

3.3.6 Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions 2015

Diagnostic Mode 06 makes it possible to retrieve test results for special components and systems which are continuously or not continuously monitored. If the diagnosis of a system is complete, the diagnostic result and the corresponding thresholds are saved and displayed in mode 06. This data remains saved (even with the ignition off) until either new diagnostic results become available or the DTC memory is erased.

The min & max values for each individual test in Mode 06 represent the minimum & maximum operating values for a properly operating system. This data is provided to the individual aftermarket scan tool companies for development of their scan tool. Depending on the scan tool being used, the min & max values shown may vary, or be rounded up or down to the nearest decimal point depending on the aftermarket scan tool company's development process. e.g.:

	Minimum Value
GST manual documentation	0.3499
Aftermarket scan tool display	0.35

Note

Depending on the scan tool and protocol used, the information displayed in diagnostic mode 06 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), or On-Board Diagnostic Monitor Identifier (OBDMID).

Test requirements

- Exhaust system must be properly sealed between the catalytic converter and the cylinder heads.
- No DTCs stored in the DTC memory.
- Coolant temperature at least 80 °C.

Work procedure

– Connect the scan tool.

– Start the engine and let run at idle speed.

– Select Mode 6: Check test the results of components that are not continuously monitored.

Select the desired Test-ID..

The current minimum and maximum values will be displayed on the scan tool screen.

The following table is a numerical list of all“Test-IDs” that may be selected.

Monitor-ID	Component or System
$01: ⇒ page 25	Oxygen Sensor Monitor Bank 1 - Sensor 1
$02: ⇒ page 25	Oxygen Sensor Monitor Bank 1 - Sensor 2
$21: ⇒ page 26	Catalytic Converter Monitoring
$3B: ⇒ page 26	Fuel Tank EVAP System Integrity/Leak Test (0.40/1.0 mm)
$3C: ⇒ page 27	Fuel Tank EVAP System Integrity/Leak Test (0.20/0.5 mm)
$3D: ⇒ page 27	EVAP Purge Valve Function Check
$41: ⇒ page 28	Oxygen Sensor Heater Monitor Bank 1 - Sensor 1
$42: ⇒ page 28	Oxygen Sensor Heater Monitor Bank 1 - Sensor 2
$A2: ⇒ page 29	Mis-Fire Cylinder 1 Data
$A3: ⇒ page 29	Mis-Fire Cylinder 2 Data
$A4: ⇒ page 30	Mis-Fire Cylinder 3 Data
$A5: ⇒ page 30	Mis-Fire Cylinder 4 Data

Monitor-ID $01: Oxygen Sensor Monitor Bank 1 - Sensor 1

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID $01”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$83	P0133	O2 signal dynamic Bank 1 Sensor 1	0.250 V	1.999 V	Refer to DTC P0133 in the DTC summary table ⇒ page 87 .
$84	P2195 P2196	O2 sensor front/rear rationality Bank 1 Sensor 1	-0.070 V	0.070 V	Refer to DTC P2195 in the DTC summary table ⇒ page 132 . Refer to DTC P2195 in the DTC summary table ⇒ page 134 .
$89	P0133	O2 signal dynamic Bank 1 Sensor 1	0.250 V	1.999 V	Refer to DTC P0133 in the DTC summary table ⇒ page 87 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $02: Oxygen Sensor Monitor Bank 1- Sensor 2

– Connect the scan tool.

– Start the engine and run at idle.
– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID $02”.

– Select the desired “Test-ID”.
– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$05	P013A	Deceleration test - O2 transient time rich to lean Bank 1 Sensor 2.	0 s	1.000 s	Refer to DTC P013A in the DTC summary table ⇒ page 91 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .
– Switch the ignition OFF.

Monitor-ID $21: Catalytic Converter Monitoring

– Connect the scan tool.
– Start the engine and run at idle.
– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 21”.

– Select the desired “Test-ID” .
– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$84	P0420	Catalyst quality compared to borderline catalyst bank 1.	100%	655.35 %	Refer to DTC P0420 in the DTC summary table ⇒ page 103 . .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .
– Switch the ignition OFF.

Monitor-ID $3B: Fuel Tank EVAP System Integrity/Leak Test (0.40/1.0mm)

– Connect the scan tool.
– Start the engine and run at idle.
– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 3B”.

– Select the desired “Test-ID” .
– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$86	P0442	Fuel Tank Leak Test: Small leak.	900.0 Pa	8191.75 Pa	Refer to DTC P0442 the DTC summary table ⇒ page 109 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $3C: Fuel Tank EVAP System Integrity/Leak Test (0.20/0.5mm)

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 3C”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$84	P0456	Fuel Tank Leak Test, very small leak.	0.00 mm2	0.17 mm2	Refer to DTC P0456 in the DTC summary table ⇒ page 111 . .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $3D: EVAP Valve Function Check

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 3D”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$8C	P0496	Purge flow monitor valve open.	0.00000000 mA	[4.20000000..15.40000000] mA	Refer to DTC P0496 in the DTC summary table ⇒ page 113 .

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$8D	P0441	Purge flow monitor valve closed.	0.00000000 mA	[3.30000000..35.40000000] mA	Refer to DTC P0441 in the DTC summary table ⇒ page 108 . .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $41: Oxygen Sensor Heater Monitor Bank 1 - Sensor 1

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 41”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$85	P0135	Oxygen sensor heating in front of catalytic converter, diagnosis, Bank 1 Sensor 1 Ceramic temperature monitoring.	720° C	6513.5° C	Refer to DTC P0135 in the DTC summary table ⇒ page 88 . .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $42: Oxygen Sensor Heater Monitor Bank 1 - Sensor 2

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID 42”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$81	P0141	Oxygen sensor circuit diagnosis, Bank 1 Sensor 2 internal resistance test.	0.00 kΩ	1.200...32.400kΩ	Refer to DTC P0141 in the DTC summary table ⇒ page 92 . .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $A2: Mis-Fire Cylinder 1 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID A2”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0301	Misfire cylinder 1, Average value over 10 Driving Cycles.	0 - 65535 (counts)	Refer to DTC P0301 in the DTC summary table ⇒ page 97 .
$0C	P0301	Misfire cylinder 1, in this Driving Cycle.	0 - 65535 (counts)	Refer to DTC P0301 in the DTC summary table ⇒ page 97 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $A3: Mis-Fire Cylinder 2 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6 Check test the results of components that are not continuously monitored”.

Select “Monitor-ID A3:”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0302	Misfire cylinder 2, Average value over 10 Driving Cycles.	0 - 65535 (counts)	Refer to DTC P0302 in the DTC summary table ⇒ page 98 .
$0C	P0302	Misfire cylinder 2, in this Driving Cycle.	0 - 65535 (counts)	Refer to DTC P0302 in the DTC summary table ⇒ page 98 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic

repair procedure
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $A4: Mis-Fire Cylinder 3 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID A4”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0303	Misfire cylinder 3, Average value over 10 Driving Cycles.	0 - 65535 (counts)	Refer to DTC P0303 in the DTC summary table ⇒ page 98 .
$0C	P0303	Misfire cylinder 3, in this Driving Cycle.	0 - 65535 (counts)	Refer to DTC P0303 in the DTC summary table ⇒ page 98 .

– If any of components or systems fail to meet the specified values. Refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

– Switch the ignition OFF.

Monitor-ID $A5: Mis-Fire Cylinder 4 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Mode 6: Check test the results of components that are not continuously monitored”.

Select “Monitor-ID A5”.

– Select the desired “Test-ID” .

– Check specified values at idle.

Test-ID	DTC	Component or System	Min./Max. Values	Additional Information
$0B	P0304	Misfire cylinder 4, Average value over 10 Driving Cycles.	0 - 65535 (counts)	Refer to DTC P0304 in the DTC summary table ⇒ page 99 .
$0C	P0304	Misfire cylinder 4, in this Driving Cycle. .	0 - 65535 (counts)	Refer to DTC P0304 in the DTC summary table ⇒ page 99 .

– Switch the ignition OFF.

– If any of the components or systems fail to meet the specified values, refer to Diagnostic Mode 03: Interrogating Fault Memory to check for stored DTCs or the corresponding diagnostic repair procedure.

3.3.7 Diagnostic Mode 07 - Read Faults Detected During the Current or Last Driving Cycle

Mode 07 makes it possible to check emissions-related faults which appeared during the current or last driving cycle (pending DTCs).

A pending DTC is saved the first time a fault is detected (output via Mode 07).

– If the fault is detected again by the end of the following driving cycle, a confirmed DTC is entered (output via Mode 03) and the MIL is activated.
– If this malfunction is not detected again by the end of the following driving cycle, the corresponding pending code will be deleted at the end of the driving cycle.

Note

Depending on scan tool and protocol used, some of the information provided may be referred to by a different name.

Procedure

– Connect the scan tool.
– Start the engine and run at idle.

Note

If the engine does not start, crank the engine using starter for at least 5 seconds. Do not switch the ignition off afterward.

– Select Mode 7: Check test results of components that are continuously monitored.

The number of pending DTCs or 0 malfunctions detected will be displayed on the scan tool screen.

– Refer to the DTC tables for the diagnostic repair procedures.
– Switch the ignition off.

3.3.8 Diagnostic Mode 08 - Request Control of On-Board System, Test or Component

Mode 8 tank lead test is not supported on this vehicle

3.3.9 Diagnostic Mode 09 - Read Vehicle Information

Diagnostic Mode 09 makes it possible to access vehicle-specific information from the ECM and the TCM (where applicable).

Note

Depending on scan tool and protocol used, Diagnostic Mode 09 and the information provided may be referred to by a different name.

Test requirement

- No DTCs stored in the DTC memory.

Procedure

– Connect the scan tool.

– Switch the ignition on.

– Select Mode 09: Vehicle information.

– Select the desired Test-ID.

– The information requested will be displayed on the scan tool screen.

The following table is a numerical list of all Test-IDs that may be selected.

Test-ID	Diagnostic text
02:	Vehicle identification number e.g.
	♦ A different 17 digit number will be displayed for each vehicle
04:	Calibration identification e.g.
	♦ Engine Control Module (ECM)
	♦ Transmission Control Module (TCM)
06:	CVN (check sum) e.g.
	♦ EC5AE460 the check sum is different for every control module version
	♦ 000D105
08:	In Use Performance Tracking
0A:	ECU module acronym and text name

Service $0A	Request Emission Related DTC's with Permanent Status - SUPPORTED

– Switch the ignition OFF.

3.4 Engine DTC Tables

♦ ⇒ “3.4.1 Engine Control Module , 2011 – 2014 MY”, page 33

♦ ⇒ “3.4.2 Engine Control Module , 2015 MY”, page 75

3.4.1 Engine Control Module , 2011 – 2014 MY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0016	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A	– Check the Engine Speed Sensor - G28- . Refer to ⇒ “3.6.12 Engine Speed Sensor G28 , Checking”, page 187 – Check the Camshaft Position (CMP) Sensor - G40- . Refer to ⇒ “3.6.17 Camshaft Position Sensor G40 , Checking”, page 195 .	• Permissible deviation < -12 CRK rev. OR • Permissible deviation > 12 CRK rev.	---	10 Rev.	• 2 DCY
P0030	HO2S Heater Control Circuit Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178 .	• Heater voltage 4.70 - 5.40 V	• Time after engine start > 5 s • Heater commanded off	0.5 s	• 2 DCY
P0031	HO2S Heater Control Circuit Low Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178 .	• Heater voltage 0 to 3.26 V	• Time after engine start > 5 s • Heater commanded off	0.5 s	• 2 DCY
P0032	HO2S Heater Control Circuit High Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178 .	• Heater current > 5.50 A	• Time after engine start > 5 s • Heater commanded off	0.5 s	• 2 DCY
P0036	HO2S Heater Control Circuit Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180 .	• Heater voltage 2.34 to 3.59 V	• Engine speed > 80 RPM • Heater, Commanded off	0.5 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0037	HO2S Heater Control Circuit Low Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180 .	• Heater voltage < 2.34 V	• Engine speed > 80 RPM • Heater, Commanded off	0.5 s	• 2 DCY
P0038	HO2S Heater Control Circuit High Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180 .	Heater voltage > 3.59 V	• Engine speed > 80 RPM • Heater, Commanded off	0.5 s	• 2 DCY
P0070	Ambient Air Temperature Sensor Circuit	– Refer to the appropriate repair manual	Ambient air temperature < -50 °C	CAN active	6 s	• 2 DCY
P0071	Ambient Air Temperature Sensor Range / Performance	– Refer to the appropriate repair manual	• Difference in value IAT vs. ECT @ engine start (depending on engine off time) < 25 °K • Difference in value IAT vs AAT @ engine start > 25 °K (depending on engine off time) • Difference in value ECT vs AAT @ engine start > 25 °K (depending on engine off time)	• Engine off time > 6 hours • ECT @ engine start < 2 °K minus • ECT @ time after engine start 180 s • AAT @ engine start < 2 °K minus • AAT @ condition veh speed > 40 km/h for time > 5 s • IAT @ engine start < 2 °K minus • IAT @ condition veh speed > 40 km/h for time > 5 s	0 s	• 2 DCY
P0072	Ambient Air Temperature Sensor Circuit Low	– Refer to the appropriate repair manual	Ambient air temperature > 87 °C	CAN active	6 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0106	Manifold Absolute Pressure/ Barometric Pressure Circuit Range/ Performance	– Check the MAP / IAT sensor - G71/ G42- . Refer to ⇒ “3.6.9 Intake Air Temperature Sensor G42 / Manifold Absolute Pressure Sensor G71 , Checking”, page 183 . If there is no fault found with the Charge Air Pressure sensor or wiring, check for any related TSB's. The Altitude sensor is located within the ECM and will require replacement of the ECM if the reading is more than 10% out of range. Refer to the Repair Manual for ECM replacement.	• Difference of actual manifold pressure lower threshold < 0 [kPa] • Modeled range 45 - 845 [kPa] OR OR • Difference of actual manifold pressure upper threshold > 0 [kPa] • Modeled range 640 to 1055 [kPa]		2.5 s	• Multiple • 2 DCY
			• Difference between BARO sensor and MAP sensor at engine start > 60 [kPa]	• Time after engine start < 25 s • Engine speed < 330 RPM		

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
			• offset value manifold pressure for load calculation in driving condition range 2 > 5.50 [kPa]	Driving condition range 1 (omsna): • engine speed < 900 [rpm] • desired mass air flow 5.00 - 25.00 [kg/h] • delta adaptation value range 1 < 0.10 [kg/h] • for time 1.0 [s] • driving condition range 2 (opsra): • engine speed > 1400 [rpm] • manifold pressure < 49.00 [kPa] • delta adaptation value range 2 < 0.30 [kPa] • for time 8.0 [s] driving condition range 3 (opua): • desired mass air flow > 40.00 [kg/h] • manifold pressure > 59.00 [kPa] • delta adaptation value range 3 < 0.30 [kPa] • for time 5.0 [s] general: • engine operation in every driving condition >= 2 times diagnosis • evap purge system = not active • engine speed 500 - 6000 [rpm] • manifold pressure n.a. • ratio manifold pressure to barometric pressure < 0.85 [-]		

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0107	Manifold Absolute Pressure / Barometric Pressure Circuit Low	– Check the MAP / IAT sensor - G71/ G42- . Refer to ⇒ “3.6.9 Intake Air Temperature Sensor G42 / Manifold Absolute Pressure Sensor G71 , Checking”, page 183 .	• Signal voltage < 0.20 V		1 s	• Continuous • 2 DCY
P0108	Manifold Absolute Pressure / Barometric Pressure Circuit High	– Check the MAP / IAT sensor - G71/ G42- . Refer to ⇒ “3.6.9 Intake Air Temperature Sensor G42 / Manifold Absolute Pressure Sensor G71 , Checking”, page 183 .	• Signal voltage > 4.88 V		1 s	• Continuous • 2 DCY
P0111	Intake Air Temperature Sensor 1 Circuit Range/ Performance	– Check the MAP / IAT sensor - G71/ G42- . Refer to ⇒ “3.6.9 Intake Air Temperature Sensor G42 / Manifold Absolute Pressure Sensor G71 , Checking”, page 183 .	• Difference in value IAT vs. ECT @ engine start (depending on engine off time) > 25 °K • Difference in value IAT - AAT @ engine start < 25 °K (depending on engine off time) • Difference in value ECT vs AAT @ engine start > 25 °K (depending on engine off time)	• Engine off time > 6 hours • ECT @ engine start < 2 °K minus • ECT @ time after engine start 180 s • AAT @ engine start < 2 °K minus • AAT @ condition veh speed > 40 km/h for time > 5 s • IAT @ engine start < 2 °K minus • IAT @ condition veh speed > 40 km/h for time > 5 s	0 s	• 2 DCY
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	– Check the MAP / IAT sensor - G71/ G42- . Refer to ⇒ “3.6.9 Intake Air Temperature Sensor G42 / Manifold Absolute Pressure Sensor G71 , Checking”, page 183 .	• IAT > 130° C	---	5 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0113	Intake Air Temperature Sensor 1 Circuit High Input	– Check the MAP / IAT sensor - G71/ G42- . Refer to ⇒ “3.6.9 Intake Air Temperature Sensor G42 / Manifold Absolute Pressure Sensor G71 , Checking”, page 183 .	• IAT < -46° C	---	5 s	• 2 DCY
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/ Performance	– Check the Engine Coolant Temperature (ECT) Sensor - G62- . Refer to ⇒ “3.6.10 Engine Coolant Temperature Sensor G62 , Checking”, page 185 .	• diff. max ECT vs. min ECT < 1.5 [K]	Temp 1 • ECT 105 to 141 °C • ECT @ engine start 50 -141 °C • without 75 - 105 [°C] substitute ECT > -45 [°C] driving condition H: • vehicle speed 20 - 75 [mph] • mass air flow (lower threshold) 32.00 - 92.00 [kg/h] • mass air flow (upper threshold) 152.00 - 352.00 [kg/h] OR • fuel cut off active • for time required > 40.0 [s] • frequency 1 times driving condition L: • vehicle speed 0 - 20 [mph] • mass air flow (lower threshold) 4.00 [kg/h] • mass air flow (upper threshold) 24.00 - 40.00 [kg/h] • for time required > 10.0 [s] • frequency 3 times	72 s	• once / DCY • 2 DCY
P0117	Engine Coolant Temperature Sensor 1 Circuit Low Input	– Check the Engine Coolant Temperature (ECT) Sensor - G62- . Refer to ⇒ “3.6.10 Engine Coolant Temperature Sensor G62 , Checking”, page 185 .	• ECT >140° C	---	2 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0118	Engine Coolant Temperature Sensor 1 Circuit High Input	– Check the Engine Coolant Temperature (ECT) Sensor - G62- . Refer to ⇒ “3.6.10 Engine Coolant Temperature Sensor G62 , Checking”, page 185 .	• ECT < -40° C	---	2 s	• 2 DCY
P0121	Throttle/ Pedal Position Sensor/ Switch "A" Circuit Range/ Performance	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .	• TPS 1 - TPS 2 > 5.10 6.30% • Actual TPS 1 calculated value > TPS 2 calculated value • TPS 1 calc. value > 9.00%	• Engine speed > 480 RPM	0.3 s	• Multiple • 2 DCY
P0122	Throttle/ Pedal Position Sensor/ Switch "A" Circuit Low	– Check the Throttle Valve Control Module - J338- Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .	• Signal voltage < 0.20 V	---	0.1 s	• Multiple • 2 DCY
P0123	Throttle/ Pedal Position Sensor/ Switch "A" Circuit High	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .	• Signal voltage > 4.81 V	---	0.1 s	• Multiple • 2 DCY
P0130	O2 Sensor Circuit Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178	• O2S ceramic temp. < 640 °C	• Modeled exhaust temp > 300 °C • Fuel cutoff not active	15 s	• 2 DCY
P0131	HO2 Sensor Circuit Low Voltage Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178	• VM > 1.75 V • UN > 1.50 V • IA or IP > 0.30 V	---	5 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0132	O2 Sensor Circuit High Voltage Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178	• VM > 3.25 V • UN > 4.40 V • IA or IP > 7.00 V	---	5 s	• 2 DCY
P0133	O2 Sensor Circuit Slow Response Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178	Signal dynamic slope check • O2S signal front vs. modeled O2S signal ratio < 0.35 and > 0.01 • Cycles completed > 40 Oscillation check • Lambda amplitude signal > 20% • Cycles > 8 • Time lambda > lambda amplitude 400 m s Delay check • Delay modeled lambda signal minus measured signal > 460 m s • Cycles > 12	• Engine speed, 1520 - 3000 RPM • Engine load, 15 - 70.01% • ECT >= 72 °C • Catalyst temperature >= 400 °C • Lambda control, Closed loop • EVAP purge inactive • O2S ceramic temp > 715 °C • Determination of measurement window, 500 m s Oscillation and delay check • Lambda control, Closed loop • Engine load 20 - 80% • Engine speed 1340 - 3500 RPM • Actual lambda 0.75 - 1.25	• 45 s	• 2 DCY
P0135	O2 Sensor Heater Circuit Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178	• Heater duty cycle, > 90% • O2S ceramic temperature, < 715 °C • Time after O2S heater on 36 s	• Heater control, Active • Modeled exhaust gas temp, > 550 °C • ECT at start > -10 °C • Engine shutoff time > 120 s • During ECM keep alive time after ignition off < 500 s • Engine speed, idle	35 - 70 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0137	O2 Sensor Circuit Low Voltage Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ "3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking", page 180 .	Cold condition • Signal voltage, < 0.06 V • Time > 3 s • Difference of sensor voltage with load pulse vs. no load pulse < 0.01 V	case 1: sensor ready for operation • sensor voltage <= 0.40 [V] OR • sensor voltage 0.50 - 1.08 [V] case 2: sensor theoretical ready for operation • for time > 15.0 [s] • sensor sufficient heated up if exhaust temperature >= 650 [°C] • for time > 10.0 [s] OR • heater power >= 25.00 [%] • for time > 10.0 [s] General: • engine running dew point exceeded fuel cut off not active • catalyst purge not active	3 s	• multiple • 2 DCY
P0138	O2 Sensor Circuit High Voltage Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ "3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking", page 180 .	• Signal voltage > 1.08 V for > 5 s	case 1: sensor ready for operation • sensor voltage <= 0.40 [V] OR • sensor voltage 0.50 - 1.08 [V] case 2: sensor theoretical ready for operation • for time > 15.0 [s] • sensor sufficient heated up if exhaust temperature >= 650 [°C] • for time > 10.0 [s] OR • heater power >= 25.00 [%] • for time > 10.0 [s] General: • engine running dew point exceeded lambda set value > 0.995 [-]	5 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P013A	O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180 .	• EWMA filtered max differential transient time at fuel cutoff >= 0.5 s • Number of checks >= 3	• Time of fuel cutoff <= 90 s and > 5 s since last cutoff • HO2S rear ready • Exhaust temperature at sensor >= 350° C • Exhaust mass flow >= 12 kg/h • deviation between expected and measured front O2-sensor lambda signal < 8.00 [-] • after time since fuel cut off at first cylinder >= 2.5 [s] • exhaust mass flow >= 12.00 [kg/h] • exhaust mass flow dynamic within range -80.00 - 80.00 [kg/h] • sensor voltage at start of measurement > 0.56 [V] • target sensor voltage end of measurement <= 0.15 [V] • engine speed 1120 - 4000 [rpm]	10 s	• Multiple • 1 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0140	O2 Sensor Circuit No Activity Detected Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180 .	Signal voltage • Signal voltage 0.40 - 0.60 V for > 3 s and difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) >= 2.80 [V] OR • internal resistance > 40000.00 [Ω] and exhaust temperature > 600 [°C]	ase 1: sensor ready for operation • sensor voltage <= 0.40 [V] OR • sensor voltage 0.50 - 1.08 [V] case 2: sensor theoretical ready for operation • for time > 15.0 [s] • sensor sufficient heated up if exhaust temperature >= 650 [°C] • for time > 10.0 [s] OR • heater power >= 25.00 [%] • for time > 10.0 [s] General: • engine running dew point exceeded valid Ri-measurements > 10 times	25 s	• 2 DCY
P0141	O2 Sensor Heater Circuit Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180 .	• Heater resistance > 1200 - 32400 Ω	• Modeled exhaust gas temp, 300 - 680 °C • engine shut-off-time > 120.0 [s] (during ECM keep alive-time after ignition off) < 500.0 [s] • No. of checks = 10 • Fuel cutoff not active • Heater commanded on	6 s	• 2 DCY
P0169	Incorrect Fuel Composition	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 Check for contaminated / aged fuel or possible high concentration of alcohol in fuel (above 15%).	• fuel quantity incorrect • Comparison with fuel quantity incorrect • Correction factor incorrect • Difference between predicted and real air mass > 3.80%	• Engine speed > 1200 RPM	0.5 s	• continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0201	Injector Circuit Open Cylinder 1	– Check the Fuel Injector - N30- . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .	• Signal voltage 4.5 to 5.5 V • Internal logic failure	• Engine speed, > 80 RPM • Injection valve switched off	0.5 s	• 2 DCY
P0202	Injector Circuit Open Cylinder 2	– Check the Fuel Injector - N31- . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .	• Signal voltage 4.5 to 5.5 V • Internal logic failure	• Engine speed, > 80 RPM • Injection valve switched off	0.5 s	• 2 DCY
P0203	Injector Circuit Open Cylinder 3	– Check the Fuel Injector - N32- . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .	• Signal voltage 4.5 to 5.5 V • Internal logic failure	• Engine speed, > 80 RPM • Injection valve switched off	0.5 s	• 2 DCY
P0204	Injector Circuit Open Cylinder 4	– Check the Fuel Injector . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .	• Signal voltage 4.5 to 5.5 V • Internal logic failure	• Engine speed, > 80 RPM • Injection valve switched off	0.5 s	• 2 DCY
P0221	Throttle/ Pedal Position Sensor/ Switch "B" Circuit Range/ Performance	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .	• TPS 1 - TPS 2 > 5.10 to 6.30% • Actual TPS 2 calculated value > TPS 1 calculated value • TPS 2 – calc. value > 9.00%	• Engine speed > 480 RPM	0.3 s	• multiple • 2 DCY
P0222	Throttle/ Pedal Position Sensor/ Switch "B" Circuit Low	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .	• Signal voltage < 0.20 V	---	0.1 s	• multiple • 2 DCY
P0223	Throttle/ Pedal Position Sensor/ Switch "B" Circuit High	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .	• Signal voltage > 4.81 V	---	0.1 s	• multiple • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0261	Cylinder 1 Injector Circuit Low	– Check the Fuel Injector - N30- . Refer to ⇒ "3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking", page 189 .	• Signal voltage < 3.0 V	• Injection valve Commanded off • Engine speed > 80 RPM	0.5 s	• 2 DCY Actual TPS 2 calculated value > TPS 1 calculated value
P0262	Cylinder 1 Injector Circuit High	– Check the Fuel Injector - N30- . Refer to ⇒ "3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking", page 189 .	• Signal current > 2.20 to 4.0 A	• Injection valve Commanded on • Engine speed > 80 RPM	0.5 s	• 2 DCY
P0264	Cylinder 2 Injector Circuit Low	– Check the Fuel Injector - N31- . Refer to ⇒ "3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking", page 189 .	• Signal voltage < 3.0 V	• Injection valve Commanded off • Engine speed > 80 RPM	0.5 s	• 2 DCY Actual TPS 2 calculated value > TPS 1 calculated value
P0265	Cylinder 2 Injector Circuit High	– Check the Fuel Injector - N31- . Refer to ⇒ "3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking", page 189 .	• Signal current > 2.20 to 4.0 A	• Injection valve Commanded on • Engine speed > 80 RPM	0.5 s	• 2 DCY
P0267	Cylinder 3 Injector Circuit Low	– Check the Fuel Injector - N32- . Refer to ⇒ "3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking", page 189 .	• Signal voltage < 3.0 V	• Injection valve Commanded off • Engine speed > 80 RPM	0.5 s	• 2 DCY Actual TPS 2 calculated value > TPS 1 calculated value
P0268	Cylinder 3 Injector Circuit High	– Check the Fuel Injector - N32- . Refer to ⇒ "3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking", page 189 .	• Signal current > 2.20 to 4.0 A	• Injection valve Commanded on • Engine speed > 80 RPM	0.5 s	• 2 DCY
P0270	Cylinder 4 Injector Circuit Low	– Check the Fuel Injector - N33- . Refer to ⇒ "3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking", page 189 .	• Signal voltage < 3.0 V	• Injection valve Commanded off • Engine speed > 80 RPM	0.5 s	• 2 DCY Actual TPS 2 calculated value > TPS 1 calculated value

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P0271	Cylinder 4 Injector Circuit High	– Check the Fuel Injector - N33- . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .	• Signal current > 2.20 to 4.0 A	• Injection valve Commanded on • Engine speed > 80 RPM	0.5 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0300	Random/ Multiple Cylinder Misfire Detected	– Check the Spark plugs. – Check the intake system for leaks. – Check Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 – Check the Ignition Coil with Power Output Stage - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .	• Emission threshold Misfire Rate (MR), > 1.9%	Case 1: • ECT @ start ≥ -48° C • Engine speed 600 - 6300 RPM Case 2: • then Activation if ECT = > -48° C General: • Active after engine start idle - 150 [rpm] + 1 camshaft [rev] • Not in fuel cutoff mode • Rough road not detected	• 1000 Rev.	• 2 DCY
P0301	Cylinder 1 Misfire Detected	– Check the Spark plugs. – Check the intake system for leaks. – Check Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 – Check the Ignition Coil with Power Output Stage - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .	• Catalyst damage misfire rate (MR), > 1.6% - 24%	ase 1: • ECT @ start ≥ -48° C • Engine speed 600 - 6300 RPM Case 2: • then Activation if ECT = > -48° C General: • Active after engine start idle - 150 [rpm] + 1 camshaft [rev] • Not in fuel cutoff mode • Rough road not detected	• 200 Rev.	• Immediate

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0302	Cylinder 2 Misfire Detected	– Check the Spark plugs. – Check the intake system for leaks. – Check Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 – Check the Ignition Coil with Power Output Stage - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .	• Catalyst damage misfire rate (MR), > 1.6% - 24%	ase 1: • ECT @ start ≥ -48° C • Engine speed 600 - 6300 RPM Case 2: • then Activation if ECT = > -48° C General: • Active after engine start idle - 150 [rpm] + 1 camshaft [rev] • Not in fuel cutoff mode • Rough road not detected	• 200 Rev.	• Immediate
P0303	Cylinder 3 Misfire Detected	– Check the Spark plugs. – Check the intake system for leaks. – Check Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 – Check the Ignition Coil with Power Output Stage - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .	• Catalyst damage misfire rate (MR), > 1.6% - 24%	ase 1: • ECT @ start ≥ -48° C • Engine speed 600 - 6300 RPM Case 2: • then Activation if ECT = > -48° C General: • Active after engine start idle - 150 [rpm] + 1 camshaft [rev] • Not in fuel cutoff mode • Rough road not detected	• 200 Rev.	• Immediate

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0304	Cylinder 4 Misfire Detected	– Check the Spark plugs. – Check the intake system for leaks. – Check Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 – Check the Ignition Coil with Power Output Stage - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .	• Catalyst damage misfire rate (MR), > 1.6% - 24%	• Active after engine start • Engine speed 600 - 6300 RPM • IAT > -48 °C • ECT @ start > -48 ° C • Not in fuel cutoff mode • Rough road not detected • No internal CAN fault	• 200 Rev.	• Immediate
P0321	Engine Speed Input Circuit Range/ Performance	– Check the Engine Speed (RPM) Sensor - G28- . Refer to ⇒ “3.6.12 Engine Speed Sensor G28 , Checking”, page 187 .	• Comparison of counted teeth vs reference = incorrect • monitoring reference gap failure	---	1.5 s	• multiple • 2 DCY
P0322	Engine Speed Input Circuit No Signal	– Check the Engine Speed (RPM) Sensor - G28- . Refer to ⇒ “3.6.12 Engine Speed Sensor G28 , Checking”, page 187 .	• Camshaft signal > 5 [-] • Engine speed, no signal	---	2.5 s	• multiple • 2 DCY
P0324	Knock Control System Error	– Check the Knock Sensor - G61- . Refer to ⇒ “3.6.18 Knock Sensor 1 G61 , Checking”, page 196 .	• Signal fault counter (combustion) > 28.00 [-] or • Signal fault counter (measuring window) > 2.00 [-]	• Engine speed > 2500 RPM	0.5 s	• multiple • 2 DCY
P0327	Knock Sensor Circuit Low	Check the Knock Sensor - G61- . Refer to ⇒ “3.6.18 Knock Sensor 1 G61 , Checking”, page 196 .	Short to Ground: • Lower threshold < -0.70 V	Short to Ground: • Engine speed, > 1000 RPM	0.5 s	• continuous • 2 DCY
			Signal range check: • Lower threshold < 1.05 to 5.49 V	Signal range check: • Engine speed > 2400 RPM • ECT > 40° C • Engine load > 30 - 35.3%	4 s	• multiple • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0328	Knock Sensor Circuit High Input	– Check the Knock Sensor - G61- . Refer to ⇒ “3.6.18 Knock Sensor 1 G61 , Checking”, page 196 .	Short to Battery Voltage: • upper threshold > 1.00 [V]	• Engine speed, > 1000 RPM	0.5 s	• continuous • 2 DCY
			Signal Range Check: • Upper threshold > 33.00 - 90.00 V	• Engine speed, > 2400 RPM • ECT > 40 °C • Engine load > 30 to 35.30%	4 s	• multiple • 2 DCY
P0341	Camshaft Position Sensor "A" Circuit Range/ Performance	– Check the Camshaft Position (CMP) Sensor - G40- . Refer to ⇒ “3.6.17 Camshaft Position Sensor G40 , Checking”, page 195 .	• Signal pattern incorrect • Defect counter = 8 [-]	---	0.5 s	• 2 DCY
P0342	Camshaft Position Sensor Circuit Low Input	– Check the Camshaft Position (CMP) Sensor - G40- . Refer to ⇒ “3.6.17 Camshaft Position Sensor G40 , Checking”, page 195 .	• Signal voltage permanently low • Crankshaft signals = 8 [-]	---	0.5 s	• 2 DCY
P0343	Camshaft Position Sensor Circuit High Input	– Check the Camshaft Position (CMP) Sensor - G40- . Refer to ⇒ “3.6.17 Camshaft Position Sensor G40 , Checking”, page 195 .	• Signal voltage permanently high • Crankshaft signals = 8 [-]	---	0.5 s	• 2 DCY
P0351	Ignition Coil Primary/ Secondary Circuit	– Check the Ignition Coil with Power Output Stage - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .	• Signal current 0.25 to -2.0 mA • Internal check failed	• Engine speed > 680 RPM	2 s	• 2 DCY
P0353	Ignition Coil Primary/ Secondary Circuit	– Check the Ignition Coil with Power Output Stage - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .	• Signal current 0.25 to -2.0 mA • Internal check failed	• Engine speed > 680 RPM	2 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0420	Catalyst System Efficiency Below Threshold	Check the Long Term Fuel Trim for out of range reading. If Fuel Trim is out of range, correct any related codes (misfire, fuel trim faults, MAP, BARO, HO2 or ECT) before replacement of catalyst, or damage to the replacement catalyst will occur. – Check the Three Way Catalytic Converter (TWC). Refer to ⇒ “3.6.16 Three Way Catalytic Converter, TWC Checking”, page 194 . – Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178 – Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180 .	• Oxygen storage capacity (OSC) vs OSC of borderline catalyst < 1.00	Front: • Time after engine start > 0 s • Delta exhaust mass flow < 15 kg/h • Exhaust gas mass flow, lower range 20.0 - 120.0 kg/h • Exhaust gas mass flow upper range 60.0 - 160.0 kg/h • Modeled exhaust gas temp, lower range 620 - 850 °C • Modeled exhaust gas temp, upper range 640 - 780 °C • Engine speed 1200 — 4200 RPM • Number of checks, 4 • O2S front/rear, ready/no faults • SAS, not active • No misfire Main: • Time after engine start > 80 s • Delta exhaust mass flow < 30 kg/h • Exhaust gas mass flow, lower range 25.0 - 80.0 kg/h • Exhaust gas mass flow upper range 60.0 - 160.0 kg/h • Modeled exhaust gas temp, lower range 435 - 660 °C • Modeled exhaust gas temp, upper range 530 - 740 °C • Engine speed 1200 — 4200 RPM • Number of checks, 4 • O2S front/rear, ready/no faults • SAS, not active • No misfire	30 s	• Once/ DCY • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P043E	EVAP System Leak Detection Reference Orifice Low Flow	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 . – Check the EVAP System, for Leaks. Refer to ⇒ “3.6.2 EVAP System, Checking for Leaks”, page 169 – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 .	• during engine off: evap pump current during reference measurement > 40.0 [mA]	During Engine Off: • ECT at start < 4° C and > 60 °C running • AAT < 35 °C and > 4 °C • Altitude ≤ 2700 m • Time since engine start ≥ 600 s • change in battery voltage during monitoring < 1.00 [V] • engine off time >= 5.0 [s] • Integrated purge flow since last purge stop > 2 g • Integrated purge flow since last monitoring run > 0 g • Intake manifold vacuum > 100 hPa • Vehicle speed 0 to 120 km/h • Fuel volume flow <= 5 ml/Sec. • Engine speed > 30 RPM and not idle. • Front O2S ready During Engine On: • ECT > 60 [°C] • ECT @ start < 60 [° C] • AAT < 35; > 4 [°C] • altitude <= 2700 [m] • time since engine start >= 600.0 [s] • integrated evap purge flow since last purge stop > 2.0 [g] • integrated evap purge flow since last monitoring run > 0.0 [g] • intake manifold vacuum > 10.00 [kPa] • vehicle speed < 75 [mph]; >= 0 [mph]	10 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			• during engine on: evap pump current during reference measurement > 40.0 [mA]	• delta vehicle speed <= 20 [mph] • fuel volume flow <= 5.00 [ml/s] • change in battery voltage during monitoring < 1.50 [V] at least one leak detection monitor during engine off preceding engine not idle engine speed > 30 no fuel cut off no gear shift no engine stop O2S front ready P043F out of range low evap pump current during reference measurement [rpm]	3 s	

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P043F	EVAP System Leak Detection Reference Orifice High Flow	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 . – Check the EVAP System, for Leaks. Refer to ⇒ “3.6.2 EVAP System, Checking for Leaks”, page 169 – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 .	• during engine off: evap pump current during reference measurement > 40.0 [mA]	During Engine Off: • ECT at start < 4° C and > 60 °C running • AAT < 35 °C and > 4 °C • Altitude ≤ 2700 m • Time since engine start ≥ 600 s • change in battery voltage during monitoring < 1.00 [V] • engine off time >= 5.0 [s] • Integrated purge flow since last purge stop > 2 g • Integrated purge flow since last monitoring run > 0 g • Intake manifold vacuum > 100 hPa • Vehicle speed 0 to 120 km/h • Fuel volume flow <= 5 ml/Sec. • Engine speed > 30 RPM and not idle. • Front O2S ready During Engine On: • ECT > 60 [°C] • ECT @ start < 60 [° C] • AAT < 35; > 4 [°C] • altitude <= 2700 [m] • time since engine start >= 600.0 [s] • integrated evap purge flow since last purge stop > 2.0 [g] • integrated evap purge flow since last monitoring run > 0.0 [g] • intake manifold vacuum > 10.00 [kPa] • vehicle speed < 75 [mph]; >= 0 [mph]	10 s	• Once/ DCY • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			• during engine on: evap pump current during reference measurement > 40.0 [mA]	• delta vehicle speed <= 20 [mph] • fuel volume flow <= 5.00 [ml/s] • change in battery voltage during monitoring < 1.50 [V] at least one leak detection monitor during engine off preceding engine not idle engine speed > 30 no fuel cut off no gear shift no engine stop O2S front ready P043F out of range low evap pump current during reference measurement [rpm]	3.0 s	

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0441	Evaporative Emission System Incorrect Purge Flow	Inspect the EVAP system hoses for kinking or damage. If EVAP hoses are OK: – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 . – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .	• drop of EVAP pump current < 1 mA within time 12.0 s	• ECT > 60 [°C] • ECT @ start < 60 [° C] • AAT < 35; > 4 [°C] • altitude <= 2700 [m] • time since engine start >= 600.0 [s] • integrated evap purge flow since last purge stop > 2.0 [g] • integrated evap purge flow since last monitoring run > 0.0 [g] • intake manifold vacuum > 10.00 [kPa] • vehicle speed < 75; >= 0 [mph] • delta vehicle speed <= 25 [mph] • fuel volume flow <= 5.00 [ml/s] • at least one leak detection monitor during engine off preceding engine not idle engine speed > 30 [rpm] • no fuel cut off • no gear shift • no engine stop • O2S front ready • evap purge valve commanded off	33.5 s	• Once/ DCY • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0442	Evaporative Emission System Leak Detected (Small Leak)	– Check the EVAP System, for Leaks. Refer to ⇒ “3.6.2 EVAP System, Checking for Leaks”, page 169 – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 . – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .	• Modeled pressure from pump current < 9 hPa	• Time after engine start > 600 s • Difference between ECT and IAT <= 15 K • ECT at start > 4 °C • Engine off time > 5 s • AAT > 4 °C and < 35 °C • ECM keep alive time after key off < 900 s • Altitude < 2700 m • Veh. speed >= 0 • Veh speed once > 40 km/h • Any drive gear • Restart temp diff. > 0 °K • Purge valve closed • Airbag not activated	400 s once/ DCY	• 2 DCY
P0444	Evaporative Emission System Purge Control Valve Circuit Open	– Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 .	• Signal voltage > 4.70 - 5.40 V	• EVAP purge valve Commanded Off • Engine speed > 80 RPM	0.5 s	• 2 DCY
P0447	Evaporative Emission System Vent Control Circuit Open	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .	• Signal voltage > 4.7 to 5.4 V	EVAP pump solenoid commanded off.	0.5 s	• 2 DCY
P0448	Evaporative Emission System Vent Control Circuit Shorted	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .	• Signal voltage < 2.74 - 3.26 V OR • signal current > 2.2 to 4.0 A	• EVAP pump solenoid commanded on for current check or commanded off for voltage check.	0.5 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0456	Evaporative Emission System Leak Detected (very small leak)	– Check the EVAP System, for Leaks. Refer to ⇒ “3.6.2 EVAP System, Checking for Leaks”, page 169 – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 . – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .	• EVAP system leakage area calculated from pump current curve > 0.17 mm squared.	• Time after engine start > 600 s • Difference between ECT and IAT <= 15 K • ECT at start > 4 °C • Engine off time > 5 s • AAT > 4 °C and < 35 °C • ECM keep alive time after key off < 900 s • Intake manifold vac. > -2560 hPa • Altitude < 2700 m • Veh. speed >= 0 • Veh speed once > 40 km/h • Any drive gear • Restart temp diff. > 0 °K • Purge valve closed • Airbag not activated	800 s	• Once/ DCY • 2 DCY
P0458	Evaporative Emission System Purge Control Valve Circuit Low	– Check the Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 .	• Signal voltage 0.00 - 3.26 V	• EVAP purge valve, Commanded off • Engine speed > 80 RPM	0.5 s	• 2 DCY
P0459	Evaporative Emission System Purge Control Valve Circuit High	– Check the Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 .	• Signal current > 2.2 A	• EVAP purge valve, Commanded On • Engine speed > 80 RPM	0.5 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0496	Evaporative Emission System High Purge Flow	Inspect the EVAP system hoses for kinking or damage. If EVAP hoses are OK: – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170. – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .	• actual evap pump current difference between reference measurement to idle divided by pump current difference from the last leak detection phase during engine off > 1.70 [-]	• ECT > 60 [°C] • ECT @ start < 60 [°C] • AAT < 35; > 4 [°C] • altitude <= 2700 [m] • time since engine start >= 600.0 [s] • integrated evap purge flow since last purge stop > 2.0 [g] • integrated evap purge flow since last monitoring run > 0.0 [g] • intake manifold vacuum > 10.00 [kPa] • vehicle speed < 75; >= 0 [mph] • delta vehicle speed <= 25 [mph] • fuel volume flow <= 5.00 [ml/s] • at least one leak detection monitor during engine off preceding engine not idle engine speed > 30 [rpm] • no fuel cut off • no gear shift • no engine stop • O2S front ready • evap purge valve commanded off	4.5 s	• Once/DCY • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P050A	Cold Start Idle Air Control System Performance	Check for carbon buildup from reversion behind the throttle plate. If buildup is present, clean throttle body with suitable cleaner . If no deposits are present in the throttle body: – Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .	Out of range low: • Engine speed deviation > 200 RPM • RPM controller torque value >= calculated min. value Out of range high: • Engine speed deviation < -100 RPM • RPM controller torque value <= calculated min. value	• Time after engine start > 0 s • Engine speed - idle • Engine load < 34.50% • Veh speed 0 km/h • Altitude < 2700 m • ECT at start < -10 to 42 °C • IAT > -48.0 °C • Catalyst heating active	5 s	• 2 DCY
P050B	Cold Start Ignition Timing Performance	If an Engine Speed sensor code is also set, diagnose that DTC first. – Check the Ignition Coil with Power Output Stage - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .	• Difference between commanded and actual spark timing > 20%	• Time during catalyst heating > 10 s • Commanded spark retard during catalyst heating < 80% • Idle speed active • Delta engine <= 3% • Delta engine speed <= 750 RPM • Engine load <= 100.01%	8 s	• 2 DCY
P0501	Vehicle Speed Sensor Range / Performance	– Check vehicle speed signal. Refer to ⇒ “3.6.15 Vehicle Speed Signal, Checking”, page 192 .	• VSS signal < 4 mph	• ECT > 40 °C • Engine speed 1520 to 4520 RPM • Fuel cutoff active	1980 ms	• 2 DCY
P0506	Idle Air Control System RPM Lower Than Expected	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .	• Idle speed Deviation > 100 RPM and RPM controller torque value >= calculated max. value	• Vehicle speed 0 MPH • Altitude < 2700 m • IAT , > -48 °C • ECT, > -48 °C • Time after engine start > 0 s • External torque request not demanded • Engine speed = idle • Engine load 34.50%	7 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0507	Idle Air Control System RPM Higher Than Expected	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .	• Idle speed Deviation < -100 RPM and RPM controller torque value <= calculated min. value	• Vehicle speed 0 MPH • Altitude < 2700 m • IAT > -48 °C • ECT > -48 °C • Time after engine start > 0 s • External torque request not demanded • Engine speed = idle	7 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0606	ECM Processor Fault	– Replace the Engine Control Module (ECM) - J623- . Refer to the Repair Manual.	• ECM internal check failure, signal voltage driver out of range or plausibility check failed	Key on or engine running	• 2 s	• 2 DCY • Continuous
P0627	Fuel Pump Control Circuit Open	– Check the Fuel Pump power supply. Refer to ⇒ “3.6.1 Fuel Pump Relay J17 , Fuel Delivery Unit GX1 Checking”, page 166 .	Open circuit • Signal voltage 4.50 to 5.50 V Short to ground • Signal voltage < 3.0 V	• Pump relay commanded off. • Engine speed > 80 RPM	0.5 s	• 2 DCY
P0629	Fuel Pump Control Circuit High	– Check the Fuel Pump power supply. Refer to ⇒ “3.6.1 Fuel Pump Relay J17 , Fuel Delivery Unit GX1 Checking”, page 166 .	• Signal current 0.60 to 1.20 A	• Pump relay commanded on. • Engine speed > 80 RPM	0.5 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0638	Throttle Actuator Control Range/ Performance Bank 1	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .	• Time to close to reference point > 0.6 s • reference point 2.88% OR • TPS 1 signal voltage is NOT 0.40 to 0.80 V • TPS 2 signal voltage is NOT 4.20 to 4.60 V • TPS 1 and TPS 2 signal voltage is NOT 4.82 to 5.18 V	• Ignition on • Engine speed 0 RPM • IAT > -20 °C • Vehicle speed 0 km/h • ECT > -20 °C • Engine shut off time 4 s	0.3 to 5 s	• 2 DCY
P0641	Sensor Reference Voltage A Circuit Open	– If any sensor specific codes are present, perform the diagnostic for those codes first. If no sensor codes are set, replace the Engine Control Module (ECM) - J623- . Refer to the Repair Manual.	• Signal voltage deviation > +/- 0.3 V	---	0.5 s	• 2 DCY
P0651	Sensor Reference Voltage B Circuit Open	– If any sensor specific codes are present, perform the diagnostic for those codes first. If no sensor codes are set, replace the Engine Control Module (ECM) - J623- . Refer to the Repair Manual.	• Signal voltage deviation > +/- 0.3 V	---	0.5 s	• 2 DCY
P0697	Sensor Reference Voltage C Circuit Open	– If any sensor specific codes are present, perform the diagnostic for those codes first. If no sensor codes are set, replace the Engine Control Module (ECM) - J623- . Refer to the Repair Manual.	• Signal voltage deviation > +/- 0.3 V	---	0.5 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P150A	Engine Off Timer Performance	Check for related TSB's. If none apply; check the power and ground inputs to the ECM BEFORE replacing ECM. Lack of ignition off power supply will cause the timer to stop. Refer to the Wiring Diagrams for power and ground locations to the ECM. If ECM power and grounds are present; – Replace the Engine Control Module (ECM) - J623- . Refer to the Repair Manual.	• Difference between engine off time and ECM after run time < -12 s or > 12 s	• Key on after ECM after run time active • Key on during ECM after run time active • CAN active	2 s	• once / DCY • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	Check for air leaks in the exhaust system between the front O2S and the catalytic converter. If the exhaust system is sealed: – Check Oxygen Sensor 1 After Catalytic Converter - GX7- behind Three Way Catalytic Converter (TWC) . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180	• Deviation lambda control < -0.03 [-]	• Modeled exhaust gas temp 400 to 1000 °C • Exhaust gas mass flow 20 to 180 kg/h • Lambda control in closed loop, not at min or max limit • O2S front ready, no DTC • O2S rear ready, no DTC • O2 heaters active • Not in fuel cutoff, SAI off • Catalyst heating not active	40 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	If P0420 is also set, refer to that diagnostic first. – Check Oxygen Sensor 1 After Catalytic Converter - GX7- behind Three Way Catalytic Converter (TWC) . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180	• Integral part of lambda control > 0.03 [-]	• Modeled exhaust gas temp 400 to 1000 °C • Exhaust gas mass flow 20 to 180 kg/h • Lambda control in closed loop, not at min or max limit • O2S front ready, no DTC • O2S rear ready, no DTC • O2 heaters active • Not in fuel cutoff, SAI off • Catalyst heating not active	40 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2101	Throttle Actuator "A" Control Motor Circuit Range/ Performance	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .	• Duty cycle > 80% • Deviation throttle value angles vs. calculated value 4 - 50% • ECM power stage no failure	---	0.5 to 5 s	• 2 DCY
P2106	Throttle Actuator Control System - Forced Limited Power	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .	• Internal check failed	• Duty cycle > 80% or deviation throttle value angles vs. calculated value > 4 - 50%	0.5 to 5 s	• 2 DCY
P2122	Throttle/ Pedal Position Sensor/ Switch "D" Circuit Low	– Check the Accelerator Pedal Position Sensor 1 - G79- . Refer to ⇒ “3.6.5 Accelerator Pedal Module GX2 , Checking”, page 173 .	• Signal voltage < 0.61 V	---	0.5 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2123	Throttle/ Pedal Position Sensor/ Switch "D" Circuit High	– Check the Accelerator Pedal Position Sensor 1 - G79- . Refer to ⇒ “3.6.5 Accelerator Pedal Module GX2 , Checking”, page 173 .	• Signal voltage > 4.79 V	---	0.5 s	• 2 DCY
P2127	Throttle/ Pedal Position Sensor/ Switch "E" Circuit Low	– Check the Accelerator Pedal Position Sensor 1 - G79- . Refer to ⇒ “3.6.5 Accelerator Pedal Module GX2 , Checking”, page 173 .	• Signal voltage < 0.27 V	---	0.5 s	• 2 DCY
P2128	Throttle/ Pedal Position Sensor/ Switch "E" Circuit Hight	– Check the Accelerator Pedal Position Sensor 1 - G79- . Refer to ⇒ “3.6.5 Accelerator Pedal Module GX2 , Checking”, page 173 .	• Signal voltage > 2.43 V	---	0.5 s	• 2 DCY
P2138	Throttle/ Pedal Position Sensor/ Switch "D"/"E" Voltage Correlation	– Check the Accelerator Pedal Position Sensor 1 - G79- . Refer to ⇒ “3.6.5 Accelerator Pedal Module GX2 , Checking”, page 173 .	• Signal voltage sensor 1 vs. sensor 2 is > 0.17 - 0.70 V	• Signal voltage sensor 1 > 445.0 mv • Signal voltage sensor 2 > 445.0 mv	0.24 s	• 2 DCY
P2177	System too lean off idle, Bank 1	– Check the Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 . – Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178 .	• Adaptive value > 28%	• Number of injections after engine start > 1500 [-] • Engine speed < 4640 RPM • MAF 45 to 300 kg/h • ECT > 59 °C • IAT < 85 °C • Engine load 30 to 100% • O2 ready, in closed loop • EVAP purge off.	8 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2178	System too rich off idle, Bank 1	– Check the Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 . – Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178 . – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 .	• Adaptive value < -20%	• Engine speed < 1320 to 4600 RPM • Number of injections after engine start > 1500 • MAF 45 to 300 kg/h • ECT > 59 °C • IAT < 85 °C • Engine load 25 to 100% • O2 ready, in closed loop • EVAP purge off.	25 s	• 2 DCY
P2181	Cooling System Performance	– Check Engine Coolant Temperature Sensor - G62- . Refer to ⇒ “3.6.10 Engine Coolant Temperature Sensor G62 , Checking”, page 185 – Check the Engine Coolant Temperature Sensor On Radiator Outlet - G83- . Refer to ⇒ “3.6.11 Engine Coolant Temperature Sensor On Radiator Outlet G83 , Checking”, page 186 . – Check the Coolant Pump - V50- Refer to the appropriate Repair Manual. – Check the Coolant Thermostat. Refer to the Repair Manual.	• Cooling system temperature too low after a sufficient mass air flow integral 65 to 75 °C	• Begin of air mass integration when engine temp > 30 °C • ECT at start, - 10 - 80 °C • Ambient air temp -6 ° C • Fuel cutoff not active and engine load 14 - 95% • Delta ambient pressure < 1.5 kPa • Integrated air mass depending on engine temp at start and ambient air temperature 4 - 19 kg/h At time of fault decision • Average mass air flow 35 - 280 kg/h • Average veh. speed 30 - 120 km/h	200 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2184	Engine Coolant Temperature Sensor 2 Circuit Low	– Check the Engine Coolant Temperature Sensor On Radiator Outlet -G83- . Refer to ⇒ "3.6.11 Engine Coolant Temperature Sensor On Radiator Outlet G83 , Checking", page 186 .	• ECT @ Radiator Outlet > 140° C	---	2 s	• continuous • 2 DCY
P2185	Engine Coolant Temperature Sensor 2 Circuit High	– Check the Engine Coolant Temperature Sensor On Radiator Outlet -G83- . Refer to ⇒ "3.6.11 Engine Coolant Temperature Sensor On Radiator Outlet G83 , Checking", page 186 .	• ECT @ Radiator Outlet < -40° C	---	2 s	• continuous • 2 DCY
P2187	System too lean at idle Bank 1	– Check the intake system for vacuum leaks. – Check the vacuum lines for leaks – Check the Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ "3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking", page 189 . – Check the Oxygen Sensor 1 Before Catalytic Converter -GX10- . Refer to ⇒ "3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking", page 178 .	• Adaptive value > 5.02%	• Engine speed < 860 RPM • Number of injections after engine start > 1500 • MAF < 35 kg/h • ECT > 59 °C • IAT < 85 °C • Delta part load adaptation ready • O2 ready, in closed loop • EVAP purge off.	12 s	• continuous • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2188	System too rich at idle Bank 1	– Check the Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 . – Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178 – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 .	• Adaptive value < -5.02%	• Engine speed < 860 RPM • Number of injections after engine start > 1500 • MAF < 35 kg/h • ECT > 59 °C • IAT < 85 °C • Delta part load adaptation ready • O2 ready, in closed loop • EVAP purge off.	12 s	• continuous • 2 DCY
P2195	O2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178	• Delta lambda of 2nd lambda control loop > 0.07	• Modeled exhaust gas temp 400 - 1000 °C • 1st and 2nd lambda control closed loop. • Fuel cutoff not active. • Catalyst heating not active. • Exh. gas mass flow 20 - 180 kg/h	80 s	• 2 DCY
P2196	O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178	• Delta lambda of 2nd lambda control loop < -0.07	• Modeled exhaust gas temp 400 - 1000 °C • 1st and 2nd lambda control closed loop. • Fuel cutoff not active. • Catalyst heating not active. • Exh. gas mass flow 20 - 180 kg/h	80 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2237	O2 Sensor Positive Current Control Circuit/Open Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178	• O2S signal front 1.49 - 1.51 V • Delta lambda controller > 0.10	• O2S ceramic temp, 720 °C • Lambda control closed loop • Heater control active • Lambda modulation > 0.02	6.5 s	• 2 DCY
P2243	O2 Sensor Reference Voltage Circuit/ Open Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178	• O2S signal front < 0.20 V and Internal resistance > 950 Ohm • O2S signal front > 4.70 V and Internal resistance > 950 Ohm	• Heater control active	20 s	• 2 DCY
P2251	O2 Sensor Negative Current Control Circuit/Open Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178	• O2S signal front 1.47 to 1.53 V • Internal resistance > 950 Ohm	• Modeled exhaust gas temp < 750 °C • No fuel cutoff > 2 s • Heater control active	25 s	• 2 DCY
P2270	O2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180	• O2S signal rear not oscillating at reference < 0.62 to 0.63 V • Enrichment after stuck lean 20%	• Mass air flow > 22 to 120 kg/h • Modeled exhaust gas temp > 300 °C • O2 rear ready > 10 s and closed loop	215 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2271	O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 2	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ "3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking", page 180	• O2S signal rear not oscillating at reference > 0.62 to 0.63 V • Enrichment after stuck lean 20% OR Fuel Cutoff • Sensor voltage >= 0.15 V • Mass flow after fuel cutoff > 2000 to 3500 mg • 1 or more checks	• Mass air flow > 22 to 120 kg/h • Modeled exhaust gas temp > 300 °C • O2 rear ready > 10 s and closed loop OR Fuel Cutoff • Time of fuel cutoff <= 90 s • Time after last fuel cutoff >= 5 s • Exhaust temp at sensor >= 430 °C • Deviation between expected and measured front O2 lambda signal < 8.0 • Exhaust mass flow > 12 kg/h • Sensor voltage at start of measurement > 0.55 V	215 s	• 2 DCY
P2279	Intake Air System Leak	Check for air leaks from intake manifold or vacuum ports, oil fill cap not seated or oil dipstick not seated in tube. Also any engine gaskets that can cause additional air to enter the crankcase can set this fault since the PCV system is not metered. If a vacuum leak or crankcase seal is at cause, the idle may be rough or unstable.	• Offset value throttle mass flow > 13 kg/h	• Desired mass flow 0 to 25 kg/h • EVAP purge closed • EGR off	10 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2300	Ignition Coil A Primary Control Circuit Low	– Check the Ignition Coil - N152- . Refer to ⇒ "3.6.19 Ignition Coil N152 , Checking", page 198 .	• Signal current > 24.0 mA	• Engine speed > 680 RPM	2 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2301	Ignition Coil A Primary Control Circuit High	– Check the Ignition Coil - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .	• Signal current > 5.1 - 7.0 V	• Engine speed > 680 RPM	2 s	• 2 DCY
P2306	Ignition Coil C Primary Control Circuit Low	– Check the Ignition Coil - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .	• Signal current > 24.0 mA	• Engine speed > 680 RPM	2 s	• 2 DCY
P2307	Ignition Coil C Primary Control Circuit High	– Check the Ignition Coil - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .	• Signal voltage > 5.1 - 7.0 V	• Engine speed > 680 RPM	2 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P240A	Evaporative Emission System Leak Detection Pump Heater Control Circuit Open	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .	• Signal voltage > 4.7 to 5.4 V	• EVAP pump heater commanded off.	0.5 s	• 2 DCY
P240B	Evaporative Emission System Leak Detection Pump Heater Control Circuit Low	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .	• Signal voltage < 2.74 to 3.26 V	• EVAP pump heater commanded off.	0.5 s	• 2 DCY
P240C	Evaporative Emission System Leak Detection Pump Heater Control Circuit High	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .	• Signal current > 2.2 to 4.0 A	• EVAP pump heater commanded on.	0.5 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum.
P2400	Evaporative Emission System Leak Detection Pump Control Circuit Open	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .	• Signal voltage > 4.7 - 5.4 V	• EVAP pump Commanded off	0.5 s	• 2 DCY
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .	• Signal voltage > 2.74 - 3.26 V	• EVAP pump Commanded Off	0.5 s	• 2 DCY
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .	• Signal voltage at EVAP pump current measuring resistor > 1.80 - 4.0 V	• EVAP pump Commanded On	0.5 s	• 2 DCY
P2407	Evaporative Emission System Leak Detection Pump Sense Circuit Intermittent/Erratic	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .	• Fluctuation of EVAP pump current during reference measurement > 1 mA, or a drop of pump current > 6 mA for >= 3 s during pump phase.	• ECT at start < 60 °C and > 60 °C running • AAT < 35 °C and > 4 °C • Time since engine start 600 s • Integrated purge flow since last purge stop > 2 g • Integrated purge flow since last monitoring run > 0 g • Intake manifold vacuum > 100 hPa • Vehicle speed 0 to 120 km/h • Fuel volume flow <= 5 ml/Sec. • Engine speed > 30 RPM and not idle. • Front O2S ready • Altitude <= 2700 m	21.5 s	• Once/DCY • 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2414	O2 Sensor Exhaust Sample Error Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178 .	Threshold 1 • Signal voltage 3.10 - 4.77 V Threshold 2 • Signal voltage 2.5 - 3.06 V	• Lambda set value 1.6 • Fuel cut off, Not active • Heater control, closed loop • SAI not active • O2S ceramic temp > 770 °C • If low fuel signal then wait > 0 s	15 s	• 2 DCY
P2450	Evaporative Emission System Switching Valve Performance/ Stuck Open	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking” page 171 .	• EVAP pump current difference between reference measurement to idle < 3 mA	• ECT at start < 60 °C and > 60 °C running • AAT < 35 °C and > 4 °C • Time since engine start 600 s • Integrated purge flow since last purge stop > 2 g • Integrated purge flow since last monitoring run > 0 g • Intake manifold vacuum > 100 hPa • Vehicle speed 0 to 120 km/h • Fuel volume flow <= 5 ml/Sec. • Engine speed > 30 RPM and not idle. • Front O2S ready • Altitude <= 2700 m	4.5 s	• Once/ DCY • 2 DCY
P2626	O2 Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178 .	• O2S signal front > 4.81 V	• Modeled exhaust temp < 750 °C • O2S ceramic temp, 720 °C • Fuel cut off, Active • Heater control closed loop • No low fuel signal	2 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P3081	Engine Temperature Too Low	Check for a stuck open thermostat. Refer to the Repair Manual. If thermostat is OK: – Check the Engine Coolant Temperature (ECT) Sensor - G62- . Refer to ⇒ “3.6.10 Engine Coolant Temperature Sensor G62 , Checking”, page 185 .	• Difference between ECT and modeled ECT > 10.5 K	---	4 s	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
U0001	High Speed CAN Communication Bus	– Check the CAN-Bus terminal resistance. Refer to ⇒ “3.6.20 CAN-Bus Terminal Resistance, Checking”, page 200 .	• Bus Off failure or CAN message = no feedback	• Time after ignition on 500 ms	250 ms	• 2 DCY
U0002	High Speed CAN Communication Bus Performance	– Check the CAN-Bus terminal resistance. Refer to ⇒ “3.6.20 CAN-Bus Terminal Resistance, Checking”, page 200 .	• Global Time Out failure or receiving no messages	• Time after ignition on 500 ms	450 ms	• 2 DCY
U0101	Lost Communication with TCM	– Check the CAN-Bus. Refer to ⇒ “3.6.21 CAN-Bus Terminal Resistance, Transmission Control Module J217 to Engine Control Module J623 , Checking”, page 201 .	• Time Out failure. No message received by ECM	• Time after ignition on 500 ms	500 ms	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
U0121 *	Lost Communication With Anti-Lock Brake System (ABS) Control Module	Check to see if any other modules have set a loss of communication with the ABS module fault. If other modules can communicate with ABS and ECM cannot, the ECM may be at fault. If other modules have set an ABS communication error, refer to the service manual for the ABS communication diagnosis.	• No CAN communication with ABS.	• Time after ignition on 500 ms	500 ms	• 2 DCY
U0146	Lost Communication With Gateway	– Check the CAN-Bus terminal resistance. Refer to ⇒ "3.6.20 CAN-Bus Terminal Resistance, Checking", page 200 .	• CAN communication with gateway no messages received.	• Time after ignition on 500 ms	500 ms	• 2 DCY
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	Check the IPC power and ground inputs. Check the CAN Bus for an open or high resistance at the IPC connector. Refer to the wiring diagram.	• No IPC CAN messages received	• Time after ignition on 500 ms	2000 ms	• 2 DCY
U0302	Software Incompatibility with Transmission Control Module	Check for any applicable TSB's. If none pertain to this fault reflash ECM with correct software for application.	• MT coded ECM software. ECM received AT messages from TCM	• Time after ignition on 500 ms	100 ms	• 2 DCY
U0402	Invalid Data Received From Transmission Control Module	Check the CAN bus. Refer to ⇒ "3.6.21 CAN-Bus Terminal Resistance, Transmission Control Module J217 to Engine Control Module J623 , Checking", page 201	• Transmission Data Length Code incorrect or implausible messages received.	• Time after ignition on 500 ms	60 ms	• 2 DCY

DTC	Error Message	Diagnostic Procedure	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
U0415	CAN Communication With ABS Error	Refer to the Repair Manual for ABS diagnosis.	• Speed sensor initialization failed • Speed sensor low voltage error failed • Speed sensor error out of range • Implausible messages sent from ABS	• Time after ignition on 500 ms	400 to 2100 ms	• 2 DCY
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	Replace the IPC module. Refer to the Repair Manual.	• Implausible CAN messages received. • Implausible ambient temperature value	Key on and no faults with AAT status from instrument cluster or AAT electrical check. Time after ignition on 500 ms	3000 ms to 3 s	• 2 DCY

3.4.2 Engine Control Module , 2015 MY

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0016 Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A	Camshaft Position Sensor Intake angular offset check	• Permissible deviation < -12° CRK OR • Permissible deviation > 12° CRK	---	10 Rev.	• Multiple • 2 DCY	– Check the Engine Speed Sensor - G28- . Refer to ⇒ “3.6.12 Engine Speed Sensor G28 , Checking”, page 187 – Check the Camshaft Position (CMP) Sensor - G40- . Refer to ⇒ “3.6.17 Camshaft Position Sensor G40 , Checking”, page 195 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0030 HO2S Heater Control Circuit Bank 1 Sensor 1	Oxygen Sensor Heater Front Open Circuit	• Heater voltage 4.70...5.40 V	• Time after engine start > 5 Sec • Heater commanded off	0.5 Sec	• Continuous • 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178
P0031 HO2S Heater Control Circuit Low Bank 1 Sensor 1	Oxygen Sensor Heater Front Short to Ground	• Heater voltage 0...3.26 V	• Time after engine start > 5 Sec • Heater commanded off	0.5 Sec	• Continuous • 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178
P0032 HO2S Heater Control Circuit High Bank 1 Sensor 1	Oxygen Sensor Heater Front Short To Battery Plus	• Signal current > 5.50 A	• Time after engine start > 5 Sec • Heater commanded on	0.5 Sec	• Continuous • 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0036 HO2S Heater Control Circuit Bank 1 Sensor 2	Oxygen Sensors Heater rear open circuit	• Heater voltage 2.34...3.59 V	• Engine speed > 80 RPM • Heater, Commanded off	0.5 Sec	• Continuous • 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180
P0037 HO2S Heater Control Circuit Low Bank 1 Sensor 2	Oxygen Sensors Heater rear short to ground	• Heater voltage < 2.34 V	• Engine speed > 80 RPM • Heater, Commanded off	0.5 Sec	• Continuous • 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180
P0038 HO2S Heater Control Circuit High Bank 1 Sensor 2	Oxygen Sensors Heater rear short to battery plus	Heater voltage > 3.59 V	• Engine speed > 80 RPM • Heater, Commanded on	0.5 Sec	• Continuous • 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0070 Ambient Air Temperature Sensor Circuit "A"	COM: Ambient Air Temperature (AAT) Sensor communication with AAT Sensor	• AAT signal: short to battery / open circuit failure	• Time after ignition on > 2.0 Sec	1.0 Sec	• Continuous • 2 DCY	– Refer to the appropriate repair manual
P0071 Ambient Air Temperature Sensor Circuit "A" Range/ Performance	Ambient Air Temperature cross check	• Difference between IAT vs. ECT @ start (depending on engine off time) < 24.8° K • Difference between IAT @ manifold and AAT @ start (depending on engine off time) > 24.8° K • Difference between ECT vs AAT @ start (depending on engine off time) > 24.8° K	• Engine off time > 6 hours Blockheater • ECT @ start < 2.3° K minus • ECT @ condition: time after engine start 180 Sec Solar radiation case 1: • AAT @ engine start <= 2.3° K minus • AAT @ condition • Vehicle speed > 40 km/h • For time > 5 Sec Solar radiation case 2: • IAT @ manifold @ start < 2.3° K minus • IAT @ condition: • Vehicle speed > 40 km/h • For time > 5 Sec	0 Sec	• Once/ DCY • 2 DCY	– Refer to the appropriate repair manual

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0072 Ambient Air Temperature Sensor Circuit "A" Low	COM: Ambient Air Temperature (AAT) Sensor communication with AAT Sensor	• AAT signal: short to ground failure	• Time after ignition on > 2.0 Sec	1.0 Sec	• Continuous • 2 DCY	– Refer to the appropriate repair manual
P0106 Manifold Absolute Pressure/ Barometric Pressure Sensor Circuit Range/ Performance	Manifold Pressure Sensor rationality check low	• Difference manifold pressure lower threshold model < 0 [kPa] • Model range 45...845 [kPa]		2.5 Sec	• Multiple • 2 DCY	– Check the MAP / IAT sensor - G71/ G42- . Refer to ⇒ “3.6.9 Intake Air Temperature Sensor G42 / Manifold Absolute Pressure Sensor G71 , Checking”, page 183 . If there is no fault found with the Charge Air Pressure sensor or wiring, check for any related TSB's. The Altitude sensor is located within the ECM and will require replacement of the ECM if the reading is more than 10% out of range. Refer to the Repair Manual for ECM replacement.
	Manifold Pressure Sensor rationality check high	• Difference manifold pressure upper threshold model > 0 [kPa] • Model range 640...1,055 [kPa]				
	Manifold Pressure Sensor rationality check	• Difference between BARO sensor signal and MAP sensor at engine start > 7.00 kPa	• Time after engine start < 25 Sec • Engine speed < 330 RPM			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Manifold Pressure Sensor adaptation value monitoring	• offset value manifold pressure for load calculation in driving condition range 2 > 5.50 [kPa] • offset value manifold pressure for load calculation in driving condition range 2 < —6.00 kPa	Driving condition range 1 (omsna): • engine speed < 900 [rpm] • desired mass air flow 5.00...25.00 [kg/h] • delta adaptation value range 1 < 0.10 [kg/h] • for time 1.0 [s] • driving condition range 2 (opsra): • engine speed > 1400 [rpm] • manifold pressure < 49.00 [kPa] • delta adaptation value range 2 < 0.30 [kPa] • for time 8.0 [s] driving condition range 3 (opua): • desired mass air flow > 40.00 [kg/h] • manifold pressure > 59.00 [kPa] • delta adaptation value range 3 < 0.30 [kPa] • for time 5.0 [s] general: • engine operation in every driving condition >= 2 times diagnosis • Diagnosis evap purge system = not active • engine speed 500...6,000 [rpm] • manifold pressure > 0.00 kPa • Ratio manifold pressure to barometric pressure < 0.85 [-]			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0107 Manifold Absolute Pressure/ Barometric Pressure Sensor Circuit Low	Manifold Pressure Sensor short to ground	• Signal voltage < 0.20 V		1 Sec	• Continuous • 2 DCY	– Check the MAP / IAT sensor - G71/ G42- . Refer to ⇒ “3.6.9 Intake Air Temperature Sensor G42 / Manifold Absolute Pressure Sensor G71 , Checking”, page 183 .
P0108 Manifold Absolute Pressure/ Barometric Pressure Sensor Circuit High	Manifold Absolute Pressure / Barometric Pressure Circuit High	• Signal voltage > 4.86 V		1 Sec	• Continuous • 2 DCY	– Check the MAP / IAT sensor - G71/ G42- . Refer to ⇒ “3.6.9 Intake Air Temperature Sensor G42 / Manifold Absolute Pressure Sensor G71 , Checking”, page 183 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0111 Intake Air Temperature Sensor 1 Circuit Range/Performance Bank 1	Intake Air Temperature cross check	• Difference between IAT and ECT @ start (depending on engine off time) > 24.8° K • Difference between IAT @ manifold and AAT @ start (depending on engine off time) > 24.8° K • Difference between AAT and ECT @ start (depending on engine off time) < 24.8° K	• Engine off time > 6 hours Blockheater • ECT @ engine start < 2.3° K minus • ECT @ condition: • Time after engine start 180 Sec Solar radiation case 1: • AAT @ start <= 2.3° K minus • AAT @ condition: • Vehicle speed > 40 km/h • For time > 5 Sec Solar radiation case 2: • IAT @ manifold @ start <= 2.3° K minus • IAT @ condition: • Vehicle speed > 40 km/h • For time > 5 Sec	0 Sec	• Once/DCY • 2 DCY	– Check the MAP / IAT sensor - G71/ G42- . Refer to ⇒ “3.6.9 Intake Air Temperature Sensor G42 / Manifold Absolute Pressure Sensor G71 , Checking”, page 183 .
P0112 Intake Air Temperature Sensor 1 Circuit Low Bank 1	Intake Air Temperature Sensor short to ground	• IAT > 130° C	---	5 Sec	• Multiple • 2 DCY	– Check the MAP / IAT sensor - G71/ G42- . Refer to ⇒ “3.6.9 Intake Air Temperature Sensor G42 / Manifold Absolute Pressure Sensor G71 , Checking”, page 183 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0113 Intake Air Temperature Sensor 1 Circuit High Bank 1	Intake Air Temperature Sensor short to battery / open circuit	• IAT < -46° C	---	5 Sec	• Multiple • 2 DCY	– Check the MAP / IAT sensor - G71/ G42- . Refer to ⇒ “3.6.9 Intake Air Temperature Sensor G42 / Manifold Absolute Pressure Sensor G71 , Checking”, page 183 .
P0116	Engine Coolant Temperature Sensor stuck high / low - no change on signal	• difference between . max ECT vs. min ECT < 1.5 [K]	• ECT @ engine start 50...141° C • without 75...105° C substitute ECT > -45° C driving condition H: • vehicle speed 50...150 km/h • mass air flow (lower threshold) 32.00...92.00 [kg/h] • mass air flow (upper threshold) 152.00...352.00 [kg/h] OR • fuel cut off active • for time required > 40.0 Sec • frequency 1 times driving condition L: • vehicle speed 0...20 km/h • mass air flow (lower threshold) 4.00 [kg/h] • mass air flow (upper threshold) 24.00...40.00 [kg/h] • for time required > 10.0 Sec • frequency 3 times	72 Sec	• Once / DCY • 2 DCY	– Check the Engine Coolant Temperature (ECT) Sensor - G62- . Refer to ⇒ “3.6.10 Engine Coolant Temperature Sensor G62 , Checking”, page 185 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	Stuck in Range	• ECT @ start >= 75° C • ECT @ start <= 105° C	• Engine off time > 7,200...28,800 Sec	2.0 Sec		
P0117 Engine Coolant Temperature Sensor 1 Circuit Low	Engine Coolant Temperature Sensor short to ground	• ECT >140° C	---	2 Sec	• Continuous • 2 DCY	– Check the Engine Coolant Temperature (ECT) Sensor - G62- . Refer to ⇒ “3.6.10 Engine Coolant Temperature Sensor G62 , Checking”, page 185 .
P0118 Engine Coolant Temperature Sensor 1 Circuit High	Engine Coolant Temperature Sensor short to battery / open circuit	• ECT < -40° C	---	2 Sec	• Continuous • 2 DCY	– Check the Engine Coolant Temperature (ECT) Sensor - G62- . Refer to ⇒ “3.6.10 Engine Coolant Temperature Sensor G62 , Checking”, page 185 .
P0121 Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	Throttle Position Sensor 1 rationality check	• TPS 1 - TPS 2 > 5.10...6.30% • Actual TPS 1 calculated value > TPS 2 calculated value • TPS 1 calc. value > 9.00%	• Engine speed > 480 RPM	0.3 Sec	• Multiple • 2 DCY	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0122 Throttle/Pedal Position Sensor/Switch "A" Circuit Low	Throttle Position Sensor 1 out of range low	• Signal voltage < 0.20 V	---	0.1 Sec	• Multiple • 2 DCY	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .
P0123 Throttle/Pedal Position Sensor/Switch "A" Circuit High	Throttle Position Sensor 1 out of range high	• Signal voltage > 4.81 V	---	0.1 Sec	• Multiple • 2 DCY	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .
P0130 O2 Sensor Circuit Bank 1 Sensor 1	Oxygen Sensors Front Out of Range	• O2S ceramic temp. < 640° C	• Modeled exhaust gas temp > 300° C • Fuel cutoff not active	15 Sec	• Multiple • 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0131 O2 Sensor Circuit Low Voltage Bank 1 Sensor 1	Oxygen Sensors Front Signal Range Check	SHORT TO GROUND: • Virtual mass VM < 1.75 V • Nemst voltage UN < 1.50 V • Adjustment voltage IA or IP < 0.30 V	---	5 Sec	• Continuous • 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178
P0132 O2 Sensor Circuit High Voltage Bank 1 Sensor 1	Oxygen Sensors Front Signal Range Check	SHORT TO BATTERY: • Virtual mass VM > 3.25 V • Nemst voltage UN > 4.40 V • Adjustment voltage IA or IP > 7.00 V	---	5 Sec	• Continuous • 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0133 O2 Sensor Circuit Slow Response Bank 1 Sensor 1	Oxygen Sensors front response rate monitoring, area ratio and gradient ratio	Symmetric Fault: • Difference of R2L area ratio vs. L2R area ratio -0.40...0.40 • Max value of both counters for area ratio R2L and L2R >= 3 times • Delay Time: • Gradient ratio >= 0.25 • Lower value of both area ratios R2L and L2R < 0.25 • Transient Time: • Gradient ratio >= 0.25 • Gradient ratio <= 0.40 • Lower value of both area ratios R2L and L2R < 0.25 • OR • Lower value of both gradient ratios R2L and L2R < 0.25 ASYMMETRIC FAULT: • Difference of R2L area ratio vs. L2R area ratio < —0.40; > 0.40 • Values of both counters for area ratio R2L and L2R >= 3 times • Delay Time: • Gradient ratio >= 0.25 • Lower value of both area ratios R2L and L2R < 0.40 • Transient Time:	• O2S front - min. operation temperature is reached > 720° C • O2S front - time since operation readiness > 20.0 Sec • Engine speed, 1520...3000 RPM • Engine load, 15...70.01% • Gradient of engine load <= 4.99% • Exhaust system lag time calculation 0.1...0.3 Sec • ECT >= 72° C • Catalyst temperature >= 400° C • Lambda control setpoint prior to diagnostic fuel steps = A/F Ratio stoichiometric • Relative fuel amount from wall-applied compensation and evap purge <= 0.70 • Time since last measurement > 3.0 Sec • Gear shifting n.a. • EVAP purge not active • OR • Integrated evap purge mass > 8.0 g • 2nd lambda control loop not active • Forced lambda oscillation not active • AIR not active • Tank leakage detection not active • Diagnosis evap purge system not active	33 Sec	• Once/ DCY • 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		• Gradient ratio >= 0.25 • Gradient ratio <= 0.40 • Lower value of both area ratios R2L and L2R < 0.40 • OR • Lower value of both gradient ratios R2L and L2R < 0.25	• Fuel cut off for any cylinders not active • Open circuit pump current ready ONLY FLEX FUEL SYSTEMS WITHOUT ETHANOL SENSOR: • Ethanol concentration adaptation; not active			
P0135 O2 Sensor Heater Circuit Bank 1 Sensor 1	Oxygen Sensors Heater front out of range high/ rationality check	• Heater duty cycle, > 90% • O2S ceramic temperature, < 720° C • Time after O2S heater on 35 Sec	• Heater control, Active • Modeled exhaust gas temp, > 550° C • ECT at start > -10° C • Engine shutoff time > 120 Sec • During ECM keep alive time after ignition off < 500 Sec	35 - 70 Sec	• Multiple • 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0137 O2 Sensor Circuit Low Voltage Bank 1 Sensor 2	Oxygen Sensors rear O2S signal check - circuit continuity	• Signal voltage, < 0.06 V • Time > 3 Sec • Difference of sensor voltage with load pulse vs. no load pulse < 0.01 V	case 1: sensor ready for operation • Sensor voltage <= 0.40 [V] OR • Sensor voltage 0.50...1.08 [V] CASE 2: sensor theoretical ready for operation • For time > 15.0 [s] • Sensor sufficient heated up if exhaust temperature >= 650° C • For time > 10.0 Sec OR • Heater power >= 25.00 % • For time > 10.0 Sec General: • engine running • dew point exceeded • fuel cut off not active • catalyst purge not active	3 Sec	• Multiple • 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 Checking”, page 180 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0138 O2 Sensor Circuit High Voltage Bank 1 Sensor 2	Oxygen Sensors rear O2S signal check out of range high (short to battery plus)	• Signal voltage > 1.08 V • For time > 5.0 Sec	case 1: sensor ready for operation • Sensor voltage <= 0.40 [V] OR • Sensor voltage 0.50...1.08 [V] CASE 2: sensor theoretical ready for operation • For time > 15.0 [s] • Sensor sufficient heated up if exhaust temperature >= 650° C • For time > 10.0 Sec OR • Heater power >= 25.00 % • For time > 10.0 Sec General: • engine running • dew point exceeded • Lambda set value > 0.995	5 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P013A O2 Sensor Slow Response - Rich to Lean Bank 1 Sensor 2	Oxygen Sensors Rear Check of Differential Transient Time at Fuel Cut-Off	• EWMA filtered max differential transient time at fuel cutoff >= 0.5 Sec • Number of checks >= 3	• O2S front out of range ready, no fault • O2S rear; ready • Engine speed 1120...4000 RPM • Exhaust gas mass flow > 12.00 kg/h • Modeled exhaust gas temperature fitted position O2S rear >= 350° C • Change of exhaust gas mass flow — 80.00...80.00 kg/h • Time fuel cut off < 90.0 Sec • IF • Time fuel cut off > 90.0 Sec • THEN • Disabling till next fuel cut off 5.0 Sec • Linear sensor front fitted • Deviation between expected and measured lambda value < 7.99 • Additional Conditions: • Time after fuel cut-off at first cylinder >= 2.5 Sec • O2S rear voltage before start of measurement > 0.56 V • O2S rear target voltage end of measurement <= 0.15 V • OR • Integrated O2 mass during fuel cut off >= 2,500...3,000 mg • Time delay 0.2 Sec	10 Sec	• Once/ DCY • 1 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			• Engine running			
P0140 O2 Sensor Circuit No Activity Detected Bank 1 Sensor 2	Oxygen sensor rear O2S signal check-circuit continuity	Signal voltage • Signal voltage 0.40...0.60 V [V] • For time > 3 Sec • AND • difference of sensor voltage with load pulse and voltage without load pulse (mean value of 3 measurements) >= 2.80 V OR • Internal resistance > 40,000.00 [Ω] • AND • Exhaust temperature > 600° C	Case 1: sensor ready for operation • Sensor voltage <= 0.40 V OR • Sensor voltage 0.50...1.08 V case 2: sensor theoretical ready for operation • For time > 15.0 Sec • Sensor sufficient heated up if exhaust temperature >= 650° C • For time > 10.0 Sec OR • Heater power >= 25.00 % • For time > 10.0 Sec General: • Engine running • Dew point exceeded • Valid Ri-measurements > 10 times	25 Sec	• Multiple • 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180 .
P0141 O2 Sensor Heater Circuit Bank 1 Sensor 2	Oxygen Sensors Heater rear out of range	• Heater resistance > 1,200 - 32,400 Ω	• Modeled exhaust gas temp. 300...680° C • engine shut-off-time > 120.0 Sec • (during ECM keep alive-time after ignition off) < 500.0 Sec • Number of checks = 10 • Fuel cutoff not active • Heater commanded on	6 Sec	• Multiple • 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0169 Incorrect Fuel Composition	ECM: Electronic Throttle Control module function monitoring: injection time	• fuel quantity incorrect • Internal check; failed • Comparison with fuel quantity incorrect • Correction factor incorrect • ABS. Difference between predicted and real air mass > 9.00%	• Internal engine speed > 1,200 RPM	0.5	• Continuous • 2 DCY	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 Check for contaminated / aged fuel or possible high concentration of alcohol in fuel (above 15%).
P0201 Cylinder 1 Injector "A" Circuit	Injection Valve Open Circuit Cylinder 1	• Signal voltage 4.5...5.5 V	• Engine speed, > 80 RPM • Injection valve switched off	0.5 Sec	• Continuous • 2 DCY	– Check the Fuel Injector - N30- . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .
P0202 Cylinder 2 Injector "A" Circuit	Injection Valve Open Circuit Cylinder 2	• Signal voltage 4.5...5.5 V	• Engine speed, > 80 RPM • Injection valve switched off	0.5 Sec	• Continuous • 2 DCY	– Check the Fuel Injector - N31- . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .
P0203 Cylinder 3 Injector "A" Circuit	Injection Valve Open Circuit Cylinder 3	• Signal voltage 4.5...5.5 V	• Engine speed, > 80 RPM • Injection valve switched off	0.5 Sec	• Continuous • 2 DCY	– Check the Fuel Injector - N32- . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .
P0204 Cylinder 4 Injector "A" Circuit	Injection Valve Open Circuit Cylinder 4	• Signal voltage 4.5...5.5 V	• Engine speed, > 80 RPM • Injection valve switched off	0.5 Sec	• Continuous • 2 DCY	– Check the Fuel Injector . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0221 Throttle/ Pedal Position Sensor/ Switch "B" Circuit Range/ Performance	Throttle/ Pedal Position Sensor/ Switch "B" Circuit Range/ Performance	• TPS 1 - TPS 2 > 5.10...6.30% • Actual TPS 2 calculated value > TPS 1 calculated value • TPS 2 – calc. value > 9.00%	• Engine speed > 480 RPM	0.3 Sec	• Multiple • 2 DCY	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .
P0222 Throttle/ Pedal Position Sensor/ Switch "B" Circuit Low	Throttle/ Pedal Position Sensor/ Switch "B" Circuit Low	• Signal voltage < 0.20 V	---	0.1 Sec.	• Multiple • 2 DCY	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .
P0223 Throttle/ Pedal Position Sensor/ Switch "B" Circuit High	Throttle/ Pedal Position Sensor/ Switch "B" Circuit High	• Signal voltage > 4.81 V	---	0.1 Sec	• Multiple • 2 DCY	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0261 Cylinder 1 Injector "A" Circuit Low	Injection Valves short to ground Cylinder 1	• Signal voltage < 3.0 V	• Injection valve Commanded off • Engine speed > 80 RPM	0.5 Sec	• Continuous • 2 DCY	– Check the Fuel Injector - N30- . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .
P0262 Cylinder 1 Injector "A" Circuit High	Injection Valves short to battery plus Cylinder 1	• Signal current 2.20...4.0 A	• Injection valve Commanded on • Engine speed > 80 RPM	0.5 Sec	• Continuous • 2 DCY	– Check the Fuel Injector - N30- . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .
P0264 Cylinder 2 Injector "A" Circuit Low	Injection Valves short to ground Cylinder 2	• Signal voltage < 3.0 V	• Injection valve Commanded off • Engine speed > 80 RPM	0.5 Sec	• Continuous • 2 DCY	– Check the Fuel Injector - N31- . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .
P0265 Cylinder 2 Injector "A" Circuit High	Injection Valves short to battery plus Cylinder 2	• Signal current 2.20...4.0 A	• Injection valve Commanded on • Engine speed > 80 RPM	0.5 Sec	• Continuous • 2 DCY	– Check the Fuel Injector - N31- . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0267 Cylinder 3 Injector "A" Circuit Low	Injection Valves short to ground Cylinder 3	• Signal voltage < 3.0 V	• Injection valve Commanded off • Engine speed > 80 RPM	0.5 Sec	• Continuous • 2 DCY	– Check the Fuel Injector - N32- . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .
P0268 Cylinder 3 Injector "A" Circuit High	Injection Valves short to battery plus Cylinder 3	• Signal current 2.20...4.0 A	• Injection valve Commanded on • Engine speed > 80 RPM	0.5 Sec	• Continuous • 2 DCY	– Check the Fuel Injector - N32- . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .
P0270 Cylinder 4 Injector "A" Circuit Low	Injection Valves short to ground Cylinder 4	• Signal voltage < 3.0 V	• Injection valve Commanded off • Engine speed > 80 RPM	0.5 Sec	• Continuous • 2 DCY	– Check the Fuel Injector - N33- . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .
P0271 Cylinder 4 Injector "A" Circuit High	Injection Valves short to battery plus Cylinder 4	• Signal current 2.20...4.0 A	• Injection valve Commanded on • Engine speed > 80 RPM	0.5 Sec	• Continuous • 2 DCY	– Check the Fuel Injector - N33- . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0300 Random/ Multiple Cylinder Misfire Detected	Misfire Crankshaft Speed Fluctuation (single or multiple)	• Emission threshold Misfire Rate (MR), > 1.5% • Catalyst damage misfire rate > 1.60...23.53 %	Case 1: • ECT @ start ≥ -48° C Case 2: • ECT @ start n.a. • Then activation if ECT > -48° C General: • Active after engine start idle - 150 [rpm] + 1 camshaft [rev] • Engine torque >= 0 Nm • Not in fuel cutoff mode • Rough road not detected	• 1000 Rev. • 200 Rev	• Continuously • 2 DCY	– Check the Spark plugs. – Check the intake system for leaks. – Check Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 – Check the Ignition Coil with Power Output Stage - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .
P0301 Cylinder 1 Misfire Detected	Misfire Crankshaft Speed Fluctuation (single or multiple)	• Emission threshold Misfire Rate (MR), > 1.5% • Catalyst damage misfire rate > 1.60...23.53 %	Case 1: • ECT @ start ≥ -48° C Case 2: • ECT @ start n.a. • Then activation if ECT > -48° C General: • Active after engine start idle - 150 [rpm] + 1 camshaft [rev] • Engine torque >= 0 Nm • Not in fuel cutoff mode • Rough road not detected	• 1000 Rev. • 200 Rev	• Continuously • 2 DCY	– Check the Spark plugs. – Check the intake system for leaks. – Check Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 – Check the Ignition Coil with Power Output Stage - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0302 Cylinder 2 Misfire Detected	Misfire Crankshaft Speed Fluctuation (single or multiple)	• Emission threshold Misfire Rate (MR), > 1.5% • Catalyst damage misfire rate > 1.60...23.53 %	Case 1: • ECT @ start ≥ -48° C Case 2: • ECT @ start n.a. • Then activation if ECT > -48° C General: • Active after engine start idle - 150 [rpm] + 1 camshaft [rev] • Engine torque >= 0 Nm • Not in fuel cutoff mode • Rough road not detected	• 1000 Rev. • 200 Rev	• Continuously • 2 DCY	– Check the Spark plugs. – Check the intake system for leaks. – Check Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 – Check the Ignition Coil with Power Output Stage - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .
P0303 Cylinder 3 Misfire Detected	Misfire Crankshaft Speed Fluctuation (single or multiple)	• Emission threshold Misfire Rate (MR), > 1.5% • Catalyst damage misfire rate > 1.60...23.53 %	Case 1: • ECT @ start ≥ -48° C Case 2: • ECT @ start n.a. • Then activation if ECT > -48° C General: • Active after engine start idle - 150 [rpm] + 1 camshaft [rev] • Engine torque >= 0 Nm • Not in fuel cutoff mode • Rough road not detected	• 1000 Rev. • 200 Rev	• Continuously • 2 DCY	– Check the Spark plugs. – Check the intake system for leaks. – Check Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 – Check the Ignition Coil with Power Output Stage - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0304 Cylinder 4 Misfire Detected	Misfire Crankshaft Speed Fluctuation (single or multiple)	• Emission threshold Misfire Rate (MR), > 1.5% • Catalyst damage misfire rate > 1.60...23.53 %	Case 1: • ECT @ start ≥ -48° C Case 2: • ECT @ start n.a. • Then activation if ECT > -48° C General: • Active after engine start idle - 150 [rpm] + 1 camshaft [rev] • Engine torque >= 0 Nm • Not in fuel cutoff mode • Rough road not detected	• 1000 Rev. • 200 Rev	• Continuously • 2 DCY	– Check the Spark plugs. – Check the intake system for leaks. – Check Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 – Check the Ignition Coil with Power Output Stage - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .
P0321 Ignition/Distributor Engine Speed Input Circuit Range/Performance	Crankshaft Position Sensor rationality check	• Counted teeth vs reference = incorrect • monitoring reference gap failure	---	1.5 Sec	• Multiple • 2 DCY	– Check the Engine Speed (RPM) Sensor - G28- . Refer to ⇒ “3.6.12 Engine Speed Sensor G28 , Checking”, page 187 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0322 Ignition/Distributor Engine Speed Input Circuit No Signal	Crankshaft Position Sensor signal activity check	• Camshaft signals > 5 [-] • Engine speed, no signal	---	2.5 Sec	• Multiple • 2 DCY	– Check the Engine Speed (RPM) Sensor - G28- . Refer to ⇒ “3.6.12 Engine Speed Sensor G28 , Checking”, page 187 .
P0324 Knock Control System Error	Knock Control System Error	• Signal fault counter (combustion) > 28.00 [-] or • Signal fault counter (measuring window) > 2.00 [-]	• Engine speed > 2,500 RPM	0.5 Sec	• Multiple • 2 DCY	– Check the Knock Sensor - G61- . Refer to ⇒ “3.6.18 Knock Sensor 1 G61 , Checking”, page 196 .
P0327 Knock Sensor Circuit Low	Knock Sensor Circuit Low	Short to Ground: • Lower threshold < -0.70 V	Short to Ground: • Engine speed > 1,000 RPM	0.5 Sec	• Continuous • 2 DCY	– Check the Knock Sensor - G61- . Refer to ⇒ “3.6.18 Knock Sensor 1 G61 , Checking”, page 196 .
		Signal range check: • Lower threshold < 1.00...5.49 V	Signal range check: • Engine speed > 2400 RPM • ECT > 40° C • Engine load > 30 - 35.3%	4 Sec	• Multiple • 2 DCY	
P0328 Knock Sensor Circuit High Input	Knock Sensor Circuit High Input	Short to Battery Voltage: • Upper threshold > 1.00 [V]	• Engine speed, > 1,000 RPM	0.5 Sec	• Continuous • 2 DCY	– Check the Knock Sensor - G61- . Refer to ⇒ “3.6.18 Knock Sensor 1 G61 , Checking”, page 196 .
		Signal Range Check: • Upper threshold > 33.00...90.00 V	• Engine speed > 2,400 RPM • ECT > 40° C • Engine load > 30...35.30%	4 Sec	• Multiple • 2 DCY	

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0341 Camshaft Position Sensor "A" Circuit Range/Performance Bank 1 or Single Sensor	Phase Sensor 1 rationality check	• Signal pattern incorrect • Defect counter = 8 [-]	---	0.5 Sec	• Continuous • 2 DCY	– Check the Camshaft Position (CMP) Sensor - G40- . Refer to ⇒ “3.6.17 Camshaft Position Sensor G40 , Checking”, page 195 .
P0342 Camshaft Position Sensor "A" Circuit Low Bank 1 or Single Sensor	Phase Sensor 1 rationality check	• Signal voltage permanently low • Crankshaft signals = 8 [-]	---	0.5 Sec	• Continuous • 2 DCY	– Check the Camshaft Position (CMP) Sensor - G40- . Refer to ⇒ “3.6.17 Camshaft Position Sensor G40 , Checking”, page 195 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0343 Camshaft Position Sensor "A" Circuit High Bank 1 or Single Sensor	Phase Sensor 1 rationality check	• Signal voltage permanently high • Crankshaft signals = 8 [-]	---	0.5 Sec	• Continuous • 2 DCY	– Check the Camshaft Position (CMP) Sensor - G40- . Refer to ⇒ “3.6.17 Camshaft Position Sensor G40 , Checking”, page 195 .
P0351 Ignition Coil "A" Primary Control Circuit/Open	Ignition Coils open circuit	• Signal current 0.25...-2.0 mA • Internal check failed	• Engine speed > 680 RPM	2.0 Sec	• Continuous • 2 DCY	– Check the Ignition Coil with Power Output Stage - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .
P0353 Ignition Coil "C" Primary Control Circuit/Open	Ignition Coils open circuit	• Signal current 0.25...-2.0 mA • Internal check failed	• Engine speed > 680 RPM	2.0 Sec	• 2 DCY	– Check the Ignition Coil with Power Output Stage - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0420 Catalyst System Efficiency Below Threshold Bank 1	Catalyst System measure of OSC compared to OSC of borderline catalyst	• Measured Oxygen storage capacity (OSC) arithmetic average value for catalyst < 1.00	• Time after engine start > n.a. • OR • Time after dew point > 0.0...5.0 Sec • Delta exhaust gas mass flow < 15 kg/h • Exhaust gas mass flow, lower range 20.0...120.0 kg/h • Exhaust gas mass flow upper range n.a. kg/h • Modeled exhaust gas temp, dynamic < 4.0 K • Modeled exhaust gas temp in catalyst system, lower range 620 - 850° C • Modeled exhaust gas temp in catalyst system, upper range n.a. • Minimum modeled exhaust gas temp in catalyst system > 350° C • For time > 120 Sec • Filtered minimum modeled exhaust gas temp in catalyst system > 350° C • Engine load 15.00...84.80% • Evap purge loading not high • Engine speed 1200...4200 RPM • Deviation between lambda < 2.00% • Setpoint and actual lambda value • Lambda control closed loop • Lambda control not at min or max limit • AAT > -48° C	30 Sec	• Once/ DCY • 2 DCY	Check the Long Term Fuel Trim for out of range reading. If Fuel Trim is out of range, correct any related codes (misfire, fuel trim faults, MAP, BARO, HO2 or ECT) before replacement of catalyst, or damage to the replacement catalyst will occur. – Check the Three Way Catalytic Converter (TWC). Refer to ⇒ “3.6.16 Three Way Catalytic Converter, TWC Checking”, page 194 . – Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178 – Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			• Number of checks, 2 • O2S front/rear, ready/no faults • AIR, not active • No misfire • O2S front plausibility check in current driving cycle ready • O2S front response monitoring in current driving cycle ready			
P043E EVAP System Leak Detection Reference Orifice Low Flow	EVAP Leak Detection Pump out of range high	• during engine off: evap pump current during reference measurement > 40.0 [mA]	During Engine Off: • ECT at start > 4° C • Difference between ECT @ start and AAT <= 15.0 K • AAT < 35; > 4° C • Barometric Pressure > 73 kPa • Time since engine start in preceeding DCY ≥ 600 s • Change in battery voltage during monitoring < 1.00 [V] • Engine off time >= 5.0 [s] • Vehicle speed 0 km/h • Evap purge adaptation < 5.00 • Deviation of filtered evap pump current during reference measurement within range <= 2.0 mA • Change in relative evap pump current during monitoring < n.a. • Within time n.a. • During ECM keep alive-time after ignition off, max time < 900 Sec • Airbag not activated	10 Sec	• Once/ DCY • 2 DCY	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 . – Check the EVAP System, for Leaks. Refer to ⇒ “3.6.2 EVAP System, Checking for Leaks”, page 169 – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		• during engine running: evap pump current during reference measurement > 40.0 [mA]	During Engine Running: • ECT > 60° C • ECT @ start < 60° C • AAT < 35; > 4° C • Barometric Pressure > 73 kPa • Time since engine start >= 600.0 Sec • Integrated evap purge mass since last purge stop > 2.0 [g] • Integrated evap purge mass since last monitoring run > 0.0 [g] • Intake manifold vacuum > 10.00 kPa • Vehicle speed < 120; >= 0 km/h • delta vehicle speed <= 30 km/h • fuel volume flow <= 5.00 [ml/s] • Change in battery voltage during monitoring < 1.50 [V] • At least one leak detection monitor during engine off = preceding • Engine = not idle • Engine speed > 30 RPM • no fuel cut off • no gear shift • no engine stop • O2S front ready	3 Sec		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P043F EVAP System Leak Detection Reference Orifice High Flow	EVAP Leak Detection Pump out of range Low	• during engine off: evap pump current during reference measurement < 15.0 [mA]	During Engine Off: • ECT at start > 4° C • Difference between ECT @ start and AAT <= 15.0 K • AAT < 35; > 4° C • Barometric Pressure > 73 kPa • Time since engine start in preceeding DCY ≥ 600 s • Change in battery voltage during monitoring < 1.00 [V] • Engine off time >= 5.0 [s] • Vehicle speed 0 km/h • Evap purge adaptation < 5.00 • Deviation of filtered evap pump current during reference measurement within range <= 2.0 mA • Change in relative evap pump current during monitoring < n.a. • Within time n.a. • During ECM keep alive-time after ignition off, max time < 900 Sec • Airbag not activated During Engine Running: • ECT > 60° C • ECT @ start < 60° C • AAT < 35; > 4° C • Barometric Pressure > 73 kPa • Time since engine start >= 600.0 Sec • Integrated evap purge mass since last purge stop > 2.0 [g]	10 Sec	• Once/ DCY • 2 DCY	– Check the Leak Detection Pump (LDP) -V144- . Refer to ⇒ "3.6.4 Leak Detection Pump V144 , Checking", page 171 . – Check the EVAP System, for Leaks. Refer to ⇒ "3.6.2 EVAP System, Checking for Leaks", page 169 – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ "3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking", page 170 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		• during engine on: evap pump current during reference measurement < 15.0 [mA]	• Integrated evap purge mass since last monitoring run > 0.0 [g] • Intake manifold vacuum > 10.00 kPa • Vehicle speed < 120; >= 0 km/h • delta vehicle speed <= 30 km/h • fuel volume flow <= 5.00 [ml/s] • Change in battery voltage during monitoring < 1.50 [V] • At least one leak detection monitor during engine off = preceding • Engine = not idle • Engine speed > 30 RPM • no fuel cut off • no gear shift • no engine stop • O2S front ready	3.0 Sec		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0441 EVAP System Incorrect Purge Flow	EVAP Purge Valve functional check: stuck close	• Drop of EVAP pump current < 1 mA • Within time 12.0 Sec	• ECT > 60° C • ECT @ start < 60° C • AAT < 35; > 4° C • Barometric Pressure > 73 kPa • Time since engine start >= 600.0 [s] • Integrated evap purge mass since last purge stop > 2.0 [g] • Integrated evap purge mass since last monitoring run > 0.0 [g] • Intake manifold vacuum > 10.00 [kPa] • Vehicle speed < 120; >= 0 km/h • Delta vehicle speed <= 30 km/h • Fuel volume flow <= 5.00 [ml/s] • At least one leak detection monitor during engine off preceding • Engine not idle • Engine speed > 30 [rpm] • Difference lambda control from min. value > 0.05 • Difference lambda control from max. value < 0.05 • No fuel cut off • No gear shift • No engine stop • O2S front ready • Evap purge valve commanded on	35.5 Sec	• Once/DCY • 2 DCY	Inspect the EVAP system hoses for kinking or damage. If EVAP hoses are OK: – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 . – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0442 EVAP System Leak Detected (small leak)	EVAP System Small Leak pressure check	• Modeled pressure from pump current < 0.90 kPa	• ECT @ start >= 4° C • Difference between ECT @ start and AAT <= 15.0 K • AAT <35; > 4° C • Barometric pressure > 73 kPa • Time since engine start in preceding DCY >= 600 s • Change in battery voltage during monitoring < 1.00 V • Engine off time > 5 s • Veh. speed >= 0 km/h • Evap purge adaptation < 5.00 • No sudden change in evap pump current (filling event) < 1.5; > -0.3 mA • Deviation of filtered evap pump current during reference measurement within range <= 2.0 mA • Change in relative evap pump current during monitoring < n.a. • Within time n.a. • ECM keep alive time after ignition off > 900 s • Airbag not activated	700 Sec	• Once/ DCY • 2 DCY	– Check the EVAP System, for Leaks. Refer to ⇒ “3.6.2 EVAP System, Checking for Leaks”, page 169 – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 . – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0444 EVAP System Purge Control Valve "A" Circuit Open	EVAP Purge Valve open circuit	• Signal voltage 4.70...5.40 V	• EVAP purge valve Commanded Off • Engine speed > 80 RPM	0.5 Sec	• Continuous • 2 DCY	– Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 .
P0447 EVAP System Vent Control Circuit Open	EVAP Leak Detection Pump Valve open circuit	• Signal voltage > 4.7...5.4 V	• EVAP pump solenoid commanded off.	0.5 Sec	• Continuous • 2 DCY	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .
P0448 EVAP System Vent Control Circuit Shorted	EVAP Leak Detection Pump Valve short to battery plus OR short to ground	Short To Ground • Signal voltage < 2.74...3.26 V	• EVAP pump solenoid commanded on.	0.5 Sec	• Continuous • 2 DCY	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .
		Short to Battery Plus • signal current > 2.2...4.0 A	• EVAP pump solenoid commanded off.			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0456 EVAP System Leak Detected (very small leak)	EVAP System Very Small Leak rationality check	• EVAP system leakage area calculated from pump current curve > 0.17 mm2	• Engine temperature @ engine start >= 4° C • Difference between ECT @ start and AAT <= 15.0 K • AAT <35; > 4° C • Barometric pressure > 73 kPa • Time since engine start in preceeding DCY > 600 s • Change in battery voltage during monitoring < 1.00 V • Engine off time > 5 s • Veh. speed >= 0 km/h • Evap purge adaptation < 5.00 • No sudden change in evap pump current (filling event) < 1.5; -0.3 mA • Deviation of filtered evap pump current during reference measurement within range <= 2.0 mA • Change in relative evap pump current during monitoring < n.a. • Within time n.a. • ECM keep alive time after ignition off < 900 s • Airbag not activated	800 Sec	• Once/ DCY • 2 DCY	– Check the EVAP System, for Leaks. Refer to ⇒ “3.6.2 EVAP System, Checking for Leaks”, page 169 – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 . – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0458 EVAP System Purge Control Valve "A" Circuit Low	EVAP Purge Valve short to ground	• Signal voltage 0.00...3.26 V	• EVAP purge valve, Commanded off • Engine speed > 80 RPM	0.5 Sec	• Continuous • 2 DCY	– Check the Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 .
P0459 EVAP System Purge Control Valve "A" Circuit High	EVAP Purge Valve short to Battery Plus	• Signal current > 2.2 A	• EVAP purge valve, Commanded On • Engine speed > 80 RPM	0.5 Sec	• Continuous • 2 DCY	– Check the Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0496 EVAP System High Purge Flow	EVAP Purge Valve functional check: stuck open	• actual evap pump current difference between reference measurement to idle divided by pump current difference from the last leak detection phase during engine off > 1.40 [-]	• ECT > 60° C • ECT @ start < 60° C • AAT < 35; > 4° C • Barometric pressure> 73 kPa • Time since engine start >= 600.0 [s] • Integrated evap purge mass since last purge stop > 2.0 [g] • Integrated evap purge mass since last monitoring run > 0.0 [g] • Intake manifold vacuum > 10.00 [kPa] • Vehicle speed < 75; >= 0 [mph] • Delta vehicle speed <= 25 [mph] • Fuel volume flow <= 5.00 [ml/s] • At least one leak detection monitor during engine off preceding • Engine not idle • engine speed > 30 [rpm] • No fuel cut off • No gear shift • No engine stop • O2S front ready • Evap purge valve commanded off	6.5 Sec	• Once/ DCY • 2 DCY	Inspect the EVAP system hoses for kinking or damage. If EVAP hoses are OK: – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 . – Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P050A Cold Start Idle Control System Performance	Cold Start Monitoring Idle Controller out of range low	• Engine speed deviation > 100 RPM • RPM controller torque value n.a.	• Catalyst heating active • Veh speed 0 km/h • Barometric pressure > 71.88 kPa • Torque safety limitation not active • Driver request not active For manual transmission: • Engine load < n.a.%	9.0 sec	• Multiple • 2 DCY	Check for carbon buildup from reversion behind the throttle plate. If buildup is present, clean throttle body with suitable cleaner . If no deposits are present in the throttle body: – Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .
	Cold Start Monitoring Idle Controller out of range high	• Engine speed deviation < -200 RPM • RPM controller torque value n.a. • Integrated number of fuel cut off transitions >= 3.00	• Catalyst heating active • Veh speed 0 km/h • Barometric pressure > 71.88 kPa • Torque safety limitation not active • Driver request not active			
P050B Cold Start Ignition Timing Performance	Cold Start Monitoring Ignition Control ignition timing monitor	• Difference between commanded and actual spark timing > 20%	• Time during catalyst heating > 10 s • Commanded spark retard during catalyst heating < 80% • Catalyst heating active • Idle speed active • Difference engine load <= 3% • Delta engine speed <= 2,000 RPM • Engine load <= 100.01%	8 Sec	• Once/ DCY • 2 DCY	If an Engine Speed sensor code is also set, diagnose that DTC first. – Check the Ignition Coil with Power Output Stage - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0501 Vehicle Speed Sensor "A" Circuit Range/ Performance	Vehicle Speed Sensor plausibility check	• VSS signal < 4 km/h	• ECT > 40° C • Engine speed 1,520...4,520 RPM • Fuel cutoff active	2.0 Sec	• Multiple • 2 DCY	– Check vehicle speed signal. Refer to ⇒ “3.6.15 Vehicle Speed Signal, Checking”, page 192 .
P0506 Idle Control System RPM - Lower Than Expected	Idle Controller out of range low	• Idle speed Deviation > 100 RPM • RPM controller torque value n.a.	• Vehicle speed 0 km/h • Barometric pressure > 71.88 kPa • IAT @ manifold > -48° C • ECT > -48° C • Torque safety limitation not active • Driver request not active • For time > 10.0 Sec For manual transmission: • Engine load < n.a.%	9.0 Sec	• Multiple • 2 DCY	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .
P0507 Idle Control System RPM - Higher Than Expected	Idle Controller out of range high	• Idle speed Deviation > 100 RPM • RPM controller torque value n.a. • Integrated number of fuel cut off transitions >= 3.00	• Vehicle speed 0 km/h • Barometric pressure > 71.88 kPa • IAT @ manifold > -48° C • ECT > -48° C • Torque safety limitation not active • Driver request not active • For time > 10.0 Sec	9.0 Sec	• Multiple • 2 DCY	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .
P0606 Control Module	Barometric Pressure Sensor Plausibility Check	• Signal gradient > 7.50 kPa/s • Signal gradient < —7.50 kPa/s		2 Sec	• Continuous • 2 DCY	– Replace the Engine Control Module (ECM) - J623- . Refer to the Repair Manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
Processor	Barometric Pressure Sensor short to battery/ open circuit	• Signal voltage >4.88 V		0.2 Sec	• Multiple • 2 DCY	
	Barometric Pressure Sensor short to ground	• Signal voltage < 0.20 V				
	Barometric Pressure Sensor out of range high	• Barometric Pressure Sensor > 115.00 kPa		2 Sec	• Continuous • 2 DCY	
	Barometric Pressure Sensor out of range low	• Barometric Pressure Sensor < 45.00 kPa		2 Sec	• Continuous • 2 DCY	
	ECM: 5V Supply Voltage internal hardware check	• Under-/ overvoltage detection		2 Sec	• Continuous • 2 DCY	
	ECM: EEPROM Functional check	• Internal checksum; failed	• Ignition = On	0.5 Sec	• Continuous • 2 DCY	
	ECM: Electronic Throttle Control Module Function monitoring: A/D converter	• Test voltage/ test pulse check; failed		0.5 Sec	• Continuous • 2 DCY	
	ECM: Electronic Throttle Control Module Function monitoring: torque	• Comparison with allowed engine torque; incorrect	• Internal engine speed >1,240 RPM	0.5 Sec	• Continuous • 2 DCY	

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	ECM: Electronic Throttle Control Module Function monitoring: Start-Stop	• Engine restart; failed		0.5 Sec	• Continuous • 2 DCY	
	ECM: Electronic Throttle Control Module Function monitoring: engine speed deviation	• Difference between calculated and internal engine speed > 320 RPM	• Internal engine speed > 520 RPM	0.5 Sec	• Continuous • 2 DCY	
	ECM: Electronic Throttle Control Module Function monitoring: Ignition timing	• Internal check; failed		0.5 Sec	• Continuous • 2 DCY	
	ECM: Electronic Throttle Control Module Function monitoring: intern/ Injection rate limitation	• System reaction; incorrect		0.5 Sec	• Continuous • 2 DCY	
	ECM: Electronic Throttle Control Module Function monitoring: accelerator position	• Internal check; failed		0.5 Sec	• Continuous • 2 DCY	
	ECM: Electronic Throttle Control Module : monitoring module	• Function controller check; failed • AND • Monitoring module check; no failure	• SPI- interface; no failure	0.5 Sec	• Continuous • 2 DCY	

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
	ECM: Self Check for Sensor Integrated Circuit internal hardware check (electrical adjustment communication, voltage supply)	• Check; failed		0.5 Sec	• Continuous • 2 DCY	
	ECM:WDA Function monitoring: WDA	• General cause; failure • Internal check; failure • Overvoltage detection; failure		0.5 Sec	• Continuous • 2 DCY	
	CAN: Controller controller RAM check	• RAM error memory checksum error	• Initialization phase	0	• Once/ DCY • 2 DCY	
P0627 Fuel Pump "A" Control Circuit/ Open	Fuel Pump Relay Open Circuit / Short to Ground	Open circuit • Signal voltage 4.50...5.50 V Short to ground • Signal voltage < 3.0 V	• Pump relay commanded off. • Engine speed > 80 RPM	0.5 Sec	• Continuous • 2 DCY	– Check the Fuel Pump power supply. Refer to ⇒ “3.6.1 Fuel Pump Relay J17 , Fuel Delivery Unit GX1 Checking”, page 166 .
P0629 Fuel Pump "A" Control Circuit High	Fuel Pump Relay Short to Battery Plus	• Signal current 0.60...1.20 A	• Pump relay commanded on. • Engine speed > 80 RPM	0.5 Sec	• Continuous • 2 DCY	– Check the Fuel Pump power supply. Refer to ⇒ “3.6.1 Fuel Pump Relay J17 , Fuel Delivery Unit GX1 Checking”, page 166 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0638 Throttle Actuator Control Range/Performance Bank 1	Throttle Actuator Basic Settings rationality check close movement	• Time to close to reference point > 0.6 Sec • reference point 2.88%	• Engine speed 0 RPM • Vehicle speed 0 km/h • IAT > -20° C • ECT > -20° C Case 1: • Ignition on Case 2: • Engine shut-off time > 0.5 Sec • Number of checks 2.00	5.0 Sec	• Multiple • 2 DCY	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .
	Throttle Actuator Basic Settings signal range check @ mechanical stop low	• TPS 1 signal voltage < 0.40; > 0.80 V • OR • TPS 2 signal voltage < 4.20; > 4.60 V • TPS 1 + TPS 2 < 4.82; > 5.18 V	• Engine speed 0 RPM • Vehicle speed 0 km/h Case 1: • Ignition on • IAT @ manifold –20...115° C • ECT > -20...115° C Case 2: • Engine shut-off time > 0.5 Sec • ECT 5...115° C • IAT @ manifold 5...143° C	0.3 Sec	• Multiple • 2 DCY	
P0641 Sensor Reference Voltage "A" Circuit/Open	ECM: Sensor Reference Circuit A signal range check	• Signal voltage deviation > +/- 0.3 V	---	0.5 Sec	• 2 DCY	– If any sensor specific codes are present, perform the diagnostic for those codes first. If no sensor codes are set, replace the Engine Control Module (ECM) - J623- . Refer to the Repair Manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P0651 Sensor Reference Voltage "B" Circuit/Open	ECM: Sensor Reference Circuit B signal range check	• Signal voltage deviation > +/- 0.3 V	---	0.5 Sec	• 2 DCY	– If any sensor specific codes are present, perform the diagnostic for those codes first. If no sensor codes are set, replace the Engine Control Module (ECM) - J623- . Refer to the Repair Manual.
P0697 Sensor Reference Voltage "C" Circuit/Open	ECM: Sensor Reference Circuit C signal range check	• Signal voltage deviation > +/- 0.3 V	---	0.5 Sec	• 2 DCY	– If any sensor specific codes are present, perform the diagnostic for those codes first. If no sensor codes are set, replace the Engine Control Module (ECM) - J623- . Refer to the Repair Manual.
P150A Engine Off Timer Performance	Engine Off Timer Performance	• Difference between engine off time and ECM after run time < -12 s or > 12 s	• Ignition = on • CAN active	2 Sec	• Once / DCY • 2 DCY	Check for related TSB's. If none apply; check the power and ground inputs to the ECM BEFORE replacing ECM. Lack of ignition off power supply will cause the timer to stop. Refer to the Wiring Diagrams for power and ground locations to the ECM. If ECM power and grounds are present; – Replace the Engine Control Module (ECM) - J623- . Refer to the Repair Manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P169A vehicle in transport mode	ECM: Transport Mode vehicle in transport mode	• Transport mode; active	For activation: • During ECM keep alive time after ignition off • Vehicle speed < 5 km/h • Engine speed 0 RPM • Max trip mileage since initial < 100 km • Vehicle start-up production mode not active For Hybrid: • Drive motor; off	0 Sec	• 1 DCY	– See appropriate repair manual to turn off Transport mode.
P1609 Airbag Safety measures due to crash with airbag activation	Airbag Safety measures due to crash with airbag activation	• Airbag(s) activated		0 Sec	• Continuous • 2 DCY	

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2096 Post Catalyst Fuel Trim System Too Lean Bank 1	Fuel System Out of range Low	• I-part of 2nd lambda control loop < -0.03 [-]	General: • Modeled exhaust gas temp 400...1000° C • Lambda control in closed loop, not at min or max limit • 2nd lambda control closed loop • O2S front ready, no DTC • O2S rear ready, no DTC • O2 heaters active • AND • Integrated exhaust gas mass > 50.0 g After the following mixture disturbances: • Time fuel cut off > 0.5 Sec • Deviation engine load n.a. • ECT < 50° C • Catalyst Heating active • AIR active • Lambda setpoint <1; > 1 • Catalyst purge active • Engine speed n.a. • for time n.a. Disabling the offset adaptation after repeated transients within a short time: • Acceleration enrichment active • OR • Deceleration enleanment active • THEN • LSU offset adaption stops if event counter > 5.00 • AND	40 Sec	• Continuous • 2 DCY	Check for air leaks in the exhaust system between the front O2S and the catalytic converter. If the exhaust system is sealed: – Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			• Exhaust gas mass flow 20.00...180.00 kg/h • OR • Exhaust gas mass flow n.a. • Within time n.a.			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2097 Post Catalyst Fuel Trim System Too Rich Bank 1	Fuel System Out of range High	• I-part of 2nd lambda control loop > 0.03 [-]	General: • Modeled exhaust gas temp 400...1000° C • Lambda control in closed loop, not at min or max limit • 2nd lambda control closed loop • O2S front ready, no DTC • O2S rear ready, no DTC • O2 heaters active • AND • Integrated exhaust gas mass > 50.0 g After the following mixture disturbances: • Time fuel cut off > 0.5 Sec • Deviation engine load n.a. • ECT < 50° C • Catalyst Heating active • AIR active • Lambda setpoint <1; > 1 • Catalyst purge active • Engine speed n.a. • for time n.a. Disabling the offset adaptation after repeated transients within a short time: • Acceleration enrichment active • OR • Deceleration enleanment active • THEN • LSU offset adaption stops if event counter > 5.00 • AND	40 Sec	• Continuous • 2 DCY	If P0420 is also set, refer to that diagnostic first. – Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			• Exhaust gas mass flow 20.00...180.00 kg/h • OR • Exhaust gas mass flow n.a. • Within time n.a.			
P2101 Throttle Actuator "A" Control Motor Circuit Range/ Performance	Throttle Actuator signal range check	• Duty cycle > 80% • ECM power stage no failure	---	5 Sec	• Continuous • 2 DCY	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .
	Throttle Actuator rationality check	• Deviation throttle value angles vs. throttle value setpoint > 4...50%		0.5 Sec	• Continuous • 2 DCY	
P2106 Throttle Actuator Control System - Forced Limited Power	Throttle Actuator short to battery plus/ short to ground	• Internal check failed		0.5 Sec	• Continuous • 2 DCY	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.6 Throttle Valve Control Module J338 , Checking”, page 175 .
	Throttle Actuator open circuit	• Internal check failed	• Duty cycle > 80% • OR • Deviation throttle value angles vs. throttle value setpoint > 4...50%	0.5 Sec	• Continuous • 2 DCY	
	Throttle Actuator temperatur / current monitoring	• Internal check failed		0.5 Sec	• Continuous • 2 DCY	
	Throttle Actuator functional check	• Internal check failed		0.5 Sec	• Continuous • 2 DCY	

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2122 Throttle/Pedal Position Sensor/Switch "D" Circuit Low	Accelerator Pedal Position Sensor 1 out of range low	• Signal voltage < 0.61 V	---	0.5 Sec	• Continuous • 2 DCY	– Check the Accelerator Pedal Position Sensor 1 - G79- . Refer to ⇒ “3.6.5 Accelerator Pedal Module GX2 , Checking”, page 173 .
P2123 Throttle/Pedal Position Sensor/Switch "D" Circuit High	Accelerator Pedal Position Sensor 1 out of range high	• Signal voltage > 4.79 V	---	0.5 Sec	• Continuous • 2 DCY	– Check the Accelerator Pedal Position Sensor 1 - G79- . Refer to ⇒ “3.6.5 Accelerator Pedal Module GX2 , Checking”, page 173 .
P2127 Throttle/Pedal Position Sensor/Switch "E" Circuit Low	Accelerator Pedal Position Sensor 2 out of range low	• Signal voltage < 0.27 V	---	0.5 Sec	• Continuous • 2 DCY	– Check the Accelerator Pedal Position Sensor 1 - G79- . Refer to ⇒ “3.6.5 Accelerator Pedal Module GX2 , Checking”, page 173 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2128 Throttle/Pedal Position Sensor/Switch "E" Circuit High	Accelerator Pedal Position Sensor 2 out of range high	• Signal voltage > 2.43 V	---	0.5 s	• Continuous • 2 DCY	– Check the Accelerator Pedal Position Sensor 1 - G79- . Refer to ⇒ “3.6.5 Accelerator Pedal Module GX2 , Checking”, page 173 .
P2138 Throttle/Pedal Position Sensor/Switch "D"/"E" Voltage Correlation	Accelerator Pedal Position Sensor 1 and 2 rationality check	• Signal voltage sensor 1 vs. sensor 2 > 0.17...0.70 V	• Signal voltage sensor 1 > 445.0 mV • Signal voltage sensor 2 > 445.0 mV	0.24 Sec	• Continuous • 2 DCY	– Check the Accelerator Pedal Position Sensor 1 - G79- . Refer to ⇒ “3.6.5 Accelerator Pedal Module GX2 , Checking”, page 173 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2177 System Too Lean Off Idle Bank 1	System too lean off idle, Bank 1	• Adaptive value > 28%	• Number of injections after engine start > 1500 • Engine speed < 4640 RPM • Engine load 30...100% • ECT > 59° C • IAT < 85° C • OR • Part load adaptation completed • Lambda control, closed loop • EVAP purge valve closed	8 Sec	• Continuous • 2 DCY	– Check the Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 . – Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178 .
P2178 System Too Rich Off Idle Bank 1	System too rich off idle, Bank 1	• Adaptive value < -20%	• Number of injections after engine start > 1500 • Engine speed < 4640 RPM • Engine load 30...100% • ECT > 59° C • IAT < 85° C • OR • Part load adaptation completed • Lambda control, closed loop • EVAP purge valve closed	8 Sec	• Continuous • 2 DCY	– Check the Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 . – Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178 . – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2181 Cooling System Performance	Engine Cooling System cooling system performance not in the expected range	• Cooling system temperature too low after a sufficient mass air flow integral < 70...73° C	MOnitor entry conditions: • ECT at start, -10...60° C • AAT -10...60° C • IAT @ manifold n.a. • Begin of air mass integration when ECT > 30° C • Accumulated integrated air mass < 0.91...2.00 kg • Fuel cutoff active • Engine load > 95% • OR • Engine load < 15.47...16.93 % • Integrated air mass 4...19 kg/h Conditions At fault decision: • (Average values since start) • Mass air flow (lower threshold) >= 35...60 kg/h • Mass air flow (upper threshold) <= 120.00...280.00 kg/h • Vehicle speed (lower threshold) >= 30 km/h • Vehicle speed (upper threshold) <= 120 km/h	260 Sec	• Once/DCY • 2 DCY	– Check Engine Coolant Temperature (ECT) Sensor . Refer to ⇒ “3.6.10 Engine Coolant Temperature Sensor G62 , Checking”, page 185 – Check the Coolant Pump - V50- Refer to the Repair Manual. – Check the Coolant Thermostat. Refer to the Repair Manual.
P2184 Engine Coolant Temperature Sensor 2 Circuit Low	Engine Coolant Temperature Sensor @ Radiator Outlet short to ground	• ECT @ Outlet > 140° C	---	2 Sec	• Continuous • 2 DCY	– Check the Engine Coolant Temperature Sensor On Radiator Outlet - G83- . Refer to ⇒ “3.6.11 Engine Coolant Temperature Sensor On Radiator Outlet G83 , Checking”, page 186 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2185 Engine Coolant Temperature Sensor 2 Circuit High	Engine Coolant Temperature Sensor @ Radiator Outlet short to battery / open circuit	• ECT @ Outlet < -40° C	---	2 Sec	• Continuous • 2 DCY	– Check the Engine Coolant Temperature Sensor On Radiator Outlet - G83- . Refer to ⇒ “3.6.11 Engine Coolant Temperature Sensor On Radiator Outlet G83 , Checking”, page 186 .
P2187 System Too Lean at Idle Bank 1	Fuel System Too Lean at Idle	• Adaptive value > 5.02%	• Number of injections after engine start > 1500 • Engine speed < 840 RPM • Engine load 9...23% • ECT > 59° C • IAT < 85° C • OR • Part load adaptation completed • Lambda control, closed loop • EVAP purge valve closed	12 Sec	• Continuous • 2 DCY	– Check the intake system for vacuum leaks. – Check the vacuum lines for leaks – Check the Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 . – Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2188 System Too Rich at Idle Bank 1	System Too Rich at Idle	• Adaptive value < -5.02%	• Number of injections after engine start > 1500 • Engine speed < 840 RPM • Engine load 9...23% • ECT > 59° C • IAT < 85° C • OR • Part load adaptation completed • Lambda control, closed loop • EVAP purge valve closed	12 Sec	• Continuous • 2 DCY	– Check the Fuel Injectors - N30, N31, N32, N33, - . Refer to ⇒ “3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking”, page 189 . – Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178 . – Check the Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80- . Refer to ⇒ “3.6.3 EVAP Canister Purge Regulator Valve 1 N80 , Checking”, page 170 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2195 O2 Sensor Signal Biased/Stuck Lean Bank 1 Sensor 1	Oxygen Sensors front out of range high	• Delta lambda of 2nd lambda control loop > 0.07	General: • Modeled exhaust gas temp 400...1000° C • Lambda control closed loop. • 2nd Lambda control closed loop. • O2S front and rear, ready • O2S front and rear heaters, ready • AND • Integrated exhaust gas mass > 50.0 g After The Following Mixture Disturbances: • Time fuel cut off > 0.5 Sec • Deviation engine load n.a. • ECT < 50° C • Catalyst heating active • AIR active • Lambda setpoint <1; >1 • Catalyst purge active Disabling The Offset Adaptation After Repeated Transients Within A Short Time: • Acceleration enrichment active • OR • Deceleration enleanment active • THEN • LSU offset adaptation stops if event counter > 5.00 • AND • Exhaust gas mass flow 20...180.00 kg/h. CASE 1:	40 Sec	• Multiple • 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			• 1st lambda control loop not at min or max limit • 2nd lambda control loop active • OR CASE 2: • 1st lambda control loop at min limit • O2S front < 1.0 • O2S rear voltage < 0.4 V • OR CASE 3: • 1st lambda control loop at max limit • O2S front > 1.0 • O2S rear voltage > 0.6 V			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2196 O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 1	Oxygen Sensors front out of range low	• Delta lambda of 2nd lambda control loop < -0.07	General: • Modeled exhaust gas temp 400...1000° C • Lambda control closed loop. • 2nd Lambda control closed loop. • O2S front and rear, ready • O2S front and rear heaters, ready • AND • Integrated exhaust gas mass > 50.0 g After The Following Mixture Disturbances: • Time fuel cut off > 0.5 Sec • Deviation engine load n.a. • ECT < 50° C • Catalyst heating active • AIR active • Lambda setpoint <1; >1 • Catalyst purge active Disabling The Offset Adaptation After Repeated Transients Within A Short Time: • Acceleration enrichment active • OR • Deceleration enleanment active • THEN • LSU offset adaptation stops if event counter > 5.00 • AND • Exhaust gas mass flow 20...180.00 kg/h. CASE 1:	40 Sec	• Multiple • 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
			• 1st lambda control loop not at min or max limit • 2nd lambda control loop active • OR CASE 2: • 1st lambda control loop at min limit • O2S front < 1.0 • O2S rear voltage < 0.4 V • OR CASE 3: • 1st lambda control loop at max limit • O2S front > 1.0 • O2S rear voltage > 0.6 V			
P2237 O2 Sensor Positive Current Control Circuit/Open Bank 1 Sensor 1	Oxygen Sensors Front Open Circuit Pump Current	• O2S voltage signal front 1.49...1.51 V • AND • Delta lambda controller > 0.10	General: • O2S ceramic temp, >720° C • Heater control closed loop CASE FUEL CUT OFF: • Electrical adjustment not active • Evap purge valve ready CASE ELSE: • Lambda modulation > 0.20 • Lambda control closed loop IF STEPWISE CHANGE LAMBDA-SETPOINT • Commanded delta lambda step 0.10	1.5...6.5 Sec	• Continuous • 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2243 O2 Sensor Reference Voltage Circuit/Open Bank 1 Sensor 1	Oxygen Sensors Front Open Circuit Nernst Voltage	• O2S signal front < 0.20 V; > 4.70 V • Internal resistance > 950 Ohm	• Heater control active	20 Sec	• Continuous • 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178
P2251 O2 Sensor Negative Current Control Circuit/Open Bank 1 Sensor 1	Oxygen Sensors Front Open Circuit Virtual Mass	• O2S voltage signal front 1.47...1.53 V • Internal resistance > 950 Ohm	• Modeled exhaust gas temp < 750° C • No fuel cutoff > 2 Sec • Heater control active	25 Sec	• Continuous • 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2270 O2 Sensor Signal Biased/Stuck Lean Bank 1 Sensor 2	Oxygen Sensors Rear Stuck Lean	• Sensor voltage < 0.76 V	• O2S rear; ready • Integrated exhaust gas mass after O2S rear ready >= 0.05 kg • Injection valve = commanded on • Engine running • IF • Integrated exhaust gas mass >= 3.50 kg • OR • Error suspicion; set • THEN • Enabling lambda ramp slope of the lambda ramp 0.05 1/ Sec • Target lambda of the lambda ramp 0.75 • Exhaust gas mass during >= 0.10 kg • Target lambda reached <= 0.75 • IF • Time fuel cut off > 3.0 Sec • Then Disabling For: • Time delay after fuel cut off 3.0 Sec • Additional Conditions: • Modeled exhaust gas 350...800° C • Engine speed 1,000...4,000 RPM • Mass air flow 20.00...150.00 kg/h • Within time 3.0 Sec	30 Sec	• Once/ DCY • 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2271 O2 Sensor Signal Biased/Stuck Rich Bank 1 Sensor 2	Oxygen Sensors Rear Stuck Rich	• Sensor voltage > 0.15 V	General: • Integrated exhaust gas mass after O2S rear ready >= 0.05 kg • O2 rear ready • Injection valve commanded on • Engine running CASE 2: • During fuel cut-off • Modeled exhaust gas temperature fitted position O2SD rear 350...800° C • O2S front lambda value > 4.00 • Fuel cut-off active • Integrated O2 mass during fuel cut off >= 5.0 g	30 Sec	• Once/DCY • 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.8 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 180
P2279 Intake Air System Leak	Leak to Intake Manifold adaptation value monitoring	• Offset value throttle mass flow > 13 kg/h • Correction factor > 0.97	• Desired mass flow 0...25 kg/h • ECT -48...143° C • EVAP purge valve closed • EGR off	2.0 Sec	• Multiple • 2 DCY	Check for air leaks from intake manifold or vacuum ports, oil fill cap not seated or oil dipstick not seated in tube. Also any engine gaskets that can cause additional air to enter the crankcase can set this fault since the PCV system is not metered. If a vacuum leak or crankcase seal is at cause, the idle may be rough or unstable.
P2300 Ignition Coil "A" Primary Control Circuit Low	Ignition Coils short to ground	• Signal current > 24.0 mA	• Engine speed > 680 RPM	2 Sec	• Continuous • 2 DCY	– Check the Ignition Coil - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2301 Ignition Coil "A" Primary Control Circuit High	Ignition Coils short to battery plus	• Signal current > 5.1...7.0 V	• Engine speed > 680 RPM	2 Sec	• Continuous • 2 DCY	– Check the Ignition Coil - N152- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .
P2306 Ignition Coil "C" Primary Control Circuit Low	Ignition Coils short to ground	• Signal current > 24.0 mA	• Engine speed > 680 RPM	2 Sec	• Continuous • 2 DCY	– Check the Ignition Coil with Power Output Stage - N291- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .
P2307 Ignition Coil "C" Primary Control Circuit High	Ignition Coils short to battery plus	• Signal voltage > 5.1 - 7.0 V	• Engine speed > 680 RPM	2 Sec	• Continuous • 2 DCY	– Check the Ignition Coil with Power Output Stage - N291- . Refer to ⇒ “3.6.19 Ignition Coil N152 , Checking”, page 198 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P240A EVAP System Leak Detection Pump Heater Control Circuit/Open	Evap Leak Detection Pump Heater Circuit Open	• Signal voltage > 4.7...5.4 V	• EVAP pump heater commanded off.	0.5 Sec	• Continuous • 2 DCY	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .
P240B EVAP System Leak Detection Pump Heater Control Circuit Low	Evap Leak Detection Pump Heater Control Short to Ground	• Signal voltage < 2.74...3.26 V	• EVAP pump heater commanded off.	0.5 Sec	• Continuous • 2 DCY	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .
P240C EVAP System Leak Detection Pump Heater Control Circuit High	Evap Leak Detection Pump Heater Control Short to Battery Plus	• Signal current > 2.2...4.0 A	• EVAP pump heater commanded on.	0.5 Sec	• Continuous • 2 DCY	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2400 EVAP System Leak Detection Pump Control Circuit/Open	Evap Leak Detection Pump Motor Circuit Open	• Signal voltage > 4.7...5.4 V	• EVAP pump electric drive Commanded off	0.5 Sec	• Continuous • 2 DCY	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .
P2401 EVAP System Leak Detection Pump Control Circuit Low	Evap Leak Detection Pump Motor Short to Ground	• Signal voltage < 2.74...3.26 V	• EVAP pump electric drive Commanded off	0.5 Sec	• Continuous • 2 DCY	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .
P2402 EVAP System Leak Detection Pump Control Circuit High	Evap Leak Detection Pump Motor Short to Battery Plus	• Signal voltage at EVAP pump current measuring resistor > 4.00...1.80 V	• EVAP pump electric drive Commanded On	0.5 Sec	• Continuous • 2 DCY	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2407 EVAP System Leak Detection Pump Sense Circuit Intermittent /Erratic	EVAP Leak Detection Pump Signal Check	During Engine Off: • Fluctuation of EVAP pump current during reference measurement > 2.0 mA, • OR • Drop of evap pump current during pump phase > 6 mA . • For time >= 3 Sec	During Engine Off: • ECT at start >= 4° C • Difference between ECT @ start and AAT <= 15.0 K • AAT < 35; > 4° C • Barometric Pressure > 73 kPa • Time since engine start in preceeding DCY ≥ 600 s • Change in battery voltage during monitoring < 1.00 [V] • Engine off time >= 5.0 [s] • Vehicle speed 0 km/h • Evap purge adaptation < 5.00 • Deviation of filtered evap pump current during reference measurement within range <= 2.0 mA • Change in relative evap pump current during monitoring < n.a. • Within time n.a. • During ECM keep alive-time after ignition off, max time < 900 Sec • Airbag not activated During Engine Running: • ECT > 60° C • ECT @ start < 60° C • AAT < 35; > 4° C • Barometric Pressure > 73 kPa • Time since engine start >= 600.0 Sec • Integrated evap purge mass since last purge stop > 2.0 [g]	800 Sec	• Once/DCY • 2 DCY	– Check the Leak Detection Pump (LDP) - V144- Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		During Engine Running: • Fluctuation of EVAP pump current during reference measurement > 3.0 mA, • OR • Drop of evap pump current during pump phase > 6 mA . • For time >= 3 Sec	• Integrated evap purge mass since last monitoring run > 0.0 [g] • Intake manifold vacuum > 10.00 kPa • Vehicle speed < 120; >= 0 km/h • delta vehicle speed <= 30 km/h • fuel volume flow <= 5.00 [ml/s] • Change in battery voltage during monitoring < 1.50 [V] • At least one leak detection monitor during engine off = preceding • Engine = not idle • Engine speed > 30 RPM • no fuel cut off • no gear shift • no engine stop • O2S front ready	23.5 Sec		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2414 O2 Sensor Exhaust Sample Error Bank 1 Sensor 1	Oxygen Sensors front signal range check	Threshold 1 • Signal voltage 3.10...4.81 V Threshold 2 • Signal voltage 2.5...3.06 V • Depending on gain factor, that actual is used for sensor characteristic, the threshold is	• Lambda set value < 1.6 • O2S ceramic temp > 720° C • Fuel cut off, Not active • Heater control, closed loop • If low fuel signal then wait n.a. • Only AIR System • AIR not active	15 Sec	• Multiple • 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178 .
P2450 EVAP System Switching Valve Performance/Stuck Open	EVAP Leak Detection Pump Signal Check	During Engine Off: • EVAP pump current difference between reference measurement to idle <= 3 mA	During Engine Off: • ECT at start >= 4° C • Difference between ECT @ start and AAT <= 15.0 K • AAT < 35; > 4° C • Barometric Pressure > 73 kPa • Time since engine start in preceeding DCY ≥ 600 s • Change in battery voltage during monitoring < 1.00 [V] • Engine off time >= 5.0 [s] • Vehicle speed 0 km/h • Evap purge adaptation < 5.00 • No sudden change in evap pump current (filling event) < 1.5; > —0.3 mA • Deviation of filtered evap pump current during reference measurement within range <= 2.0 mA • Change in relative evap pump current during monitoring < n.a. • Within time n.a.	13.5 Sec	• Once/DCY • 2 DCY	– Check the Leak Detection Pump (LDP) - V144- . Refer to ⇒ “3.6.4 Leak Detection Pump V144 , Checking”, page 171 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
		During Engine Running: • EVAP pump current difference between reference measurement to idle <= 3 mA	• During ECM keep alive-time after ignition off, max time < 900 Sec • Airbag not activated During Engine Running: • ECT > 60° C • ECT @ start < 60° C • AAT < 35; > 4° C • Barometric Pressure > 73 kPa • Time since engine start >= 600.0 Sec • Integrated evap purge mass since last purge stop > 2.0 [g] • Integrated evap purge mass since last monitoring run > 0.0 [g] • Intake manifold vacuum > 10.00 kPa • Vehicle speed < 120; >= 0 km/h • delta vehicle speed <= 30 km/h • fuel volume flow <= 5.00 [ml/s] • Change in battery voltage during monitoring < 1.50 [V] • At least one leak detection monitor during engine off = preceding • Engine = not idle • Engine speed > 30 RPM • no fuel cut off • no gear shift • no engine stop • O2S front ready	6.5 Sec		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
P2626 O2 Sensor Pumping Current Trim Circuit/Open Bank 1 Sensor 1	Oxygen Sensor Front Open Circuit Adjustment Voltage	• O2S voltage signal front > 4.81 V	• Modeled exhaust gas temp < 750° C • O2S ceramic temp > 720° C • Fuel cut off, Active • Heater control closed loop • If low fuel signal then wait n.a.	1.5 Sec	• Continuous • 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.7 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 178 .
P3081 Engine Temperature Too Low	Engine Coolant Temperature Sensor rationality check	• Difference between reference model temperature and measured ECT > 10.5 K	---	4 Sec	• Continuous • 2 DCY	Check for a stuck open thermostat. Refer to the Repair Manual. If thermostat is OK: – Check the Engine Coolant Temperature (ECT) Sensor - G62- . Refer to ⇒ “3.6.10 Engine Coolant Temperature Sensor G62 , Checking”, page 185 .
U0001 High Speed CAN Communication Bus	CAN: Powertrain BUS reading back sent message	• Message = no feedback	• Time after ignition on > 500 mS	0.25 Sec	• Continuous • 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ “3.6.20 CAN-Bus Terminal Resistance, Checking”, page 200 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
U0002 High Speed CAN Communication Bus Performance	COM: Powertrain Bus communication check	• Global Time Out; receiving no messages	• Time after ignition on > 500 mS	0.45 Sec	• Continuous • 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ “3.6.20 CAN-Bus Terminal Resistance, Checking”, page 200 .
U0101 Lost Communication with TCM	COM: Transmission Control Module (TCM) communication with TCM	• Received message; no message	• Time after ignition on > 500 mS	0.5 Sec	• Continuous • 2 DCY	– Check the CAN-Bus. Refer to ⇒ “3.6.21 CAN-Bus Terminal Resistance, Transmission Control Module J217 to Engine Control Module J623 , Checking”, page 201 .
U0121 Lost Communication With Anti-Lock Brake System (ABS) Control Module	COM: Brake System Control Module (BSCM) communication with BSCM	• Received message; no message	• Time after ignition on > 500 mS	0.5 Sec	• Continuous • 2 DCY	Check to see if any other modules have set a loss of communication with the ABS module fault. If other modules can communicate with ABS and ECM cannot, the ECM may be at fault. If other modules have set an ABS communication error, refer to the service manual for the ABS communication diagnosis.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
U0146 Lost Communication With Gateway "A"	COM: Gateway communication with Gateway	• Received message; no message	• Time after ignition on > 500 mS	0.5 Sec	• Continuous • 2 DCY	– Check the CAN-Bus terminal resistance. Refer to ⇒ "3.6.20 CAN-Bus Terminal Resistance, Checking", page 200 .
U0155 Lost Communication With Instrument Panel Cluster (IPC) Control Module	COM: Instrument Panel Cluster (IPC) communication with IPC	• Received message; no message	• Time after ignition on > 500 mS	2.0 Sec	• Continuous • 2 DCY	Check the IPC power and ground inputs. Check the CAN Bus for an open or high resistance at the IPC connector. Refer to the wiring diagram.
U0302 Software Incompatibility With Transmission Control Module	COM: Transmission Control Module (TCM) communication with TCM	• Received AT vehicle data TCM signal	• Time after ignition on > 500 mS	5.0 Sec	• Continuous • 2 DCY	Check for any applicable TSB's. If none pertain to this fault reflash ECM with correct software for application.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
U0402 Invalid Data Received From TCM	COM: Transmission Control Module (TCM) communication with TCM	• Received data; implausible message	• Time after ignition on > 500 mS	0.3 Sec	• Continuous • 2 DCY	Check the CAN bus. Refer to ⇒ "3.6.21 CAN-Bus Terminal Resistance, Transmission Control Module J217 to Engine Control Module J623 , Checking", page 201
U0415 Invalid Data Received From Anti-Lock Brake System (ABS) Control Module	Vehicle Speed Sensor out of range high	• Vehicle speed > 325 km/h • Speed sensor initialization error 327.08 km/h • Speed sensor signal low voltage error 327.25 km/h • Speed sensor signal: error out of range 326.39 km/h • Received message Implausible messages from ABS • Speed sensor signal: sensor error 327.42 km/h	• Time after ignition on 500 ms	400 to 2100 ms	• Continuous • 2 DCY	Refer to the Repair Manual for ABS diagnosis.
U0423 Invalid Data Received From Instrument Panel Cluster Control	COM: Ambient Air Temperature (AAT) Sensor communication with IPC	• AAT value (initialization) 00h	• Ignition on • Status AAT from instrument cluster no fault • Electrical check AAT sensor no fault	3.0 Sec	• Continuous • 2 DCY	– Replace the Instrument Panel Cluster. Refer to the appropriate Repair Manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illum.	Component Diagnostic Procedure
Module	COM: Instrument Panel Cluster (IPC) communication with IPC	• Received data; implausible message	• Time after ignition on > 500mS			

3.5 Transmission DTC Tables

◆ ⇒ “3.5.1 Transmission Control Module , 6-spd, 09G (2011-2015 MY)”, page 150

3.5.1 Transmission Control Module , 6-spd, 09G (2011-2015 MY)

AQ250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0604	Internal Control Module Random Access Memory (RAM) Error	• RAM area check	• comparison of writing data and reading data	• writing data is different from reading one		• 40 s	• 2 DCY
P0605	Internal Control Module Read Only Memory (ROM) Error	• ROM area check	• comparison of stored checksum value and calculated checksum	• two checksum values are not same		• 40 s	• 2 DCY
P0613	TCM Processor	• 2nd CPU detects miscalculation	• check-calculation of 1st CPU failed	• single reset does not cover problem		• XX s	• 2 DCY

AQ250 09G							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0614	ECM/ TCM Incompatible	• CAN receive data check	• detection of error signal	• transmission coding is manual transmission code (0Fh) OR • max torque is not same as one in ATCU	• CAN bus: ACTIVE • ECU communication: ACTIVE • ECU data update: ACTIVE	• 250 ms	• 2 DCY
P0705	Transmission Range Sensor "A" Circuit (PRNDL Input)	• A, B, C and PA signal check in every shift lever position	• detection of wrong combination of the A, B, C and PA signal	• wrong combination for more than 350 ms		• 350 ms	• 2 DCY
P0715	Input Turbine/ Speed Sensor "A" Circ	• Electrical check	• detection of wrong input AD value	• voltage < 0.2 volt (AD value < 45) for more than 100 ms OR • (AD value > 545) voltage > 3.8 volt for more than 100 ms	• input sensor: no failure decision for input sensor no pulse failure	• 100 ms • 5 times	• 2 DCY
P0716	Input/Turbine Shaft Speed Sensor "A" Circuit Range/ Performance	• No pulse check	• comparison pulse of input revolution and output revolution	• no pulse of input sensor more than 125 ms	• engine speed > 400 rpm • output sensor: ACTIVE • output speed >= 300 rpm • input sensor: no during failure detection or after failure decision for input sensor electrical failure	• 125 ms • 4 times	• 2 DCY

AQ250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0720	output Shaft Speed Sensor Circuit	• Electrical check	• detection of wrong input AD value	• voltage < 0.2 volt (AD value < 45) for more than 100 ms OR • (AD value > 545) voltage > 3.8 volt for more than 100 ms	• output sensor: no failure decision for output sensor no pulse	• 100 ms • 5 times	• 2 DCY
P0721	Output Shaft Speed Sensor Circuit Range/ Performance	• No pulse check	• comparison pulse of input revolution and output revolution	• no pulse of output sensor more than 250 ms	• engine speed: > 400 rpm • input sensor: ACTIVE • calculated output speed by input speed: >= 300 rpm • main solenoid switch: ON • gear condition: Engage • Range: D,S • Inhibitor switch: no fault • output sensor: no during failure detection or after failure decision for output sensor electrical failure • solenoid: no fault (except S2) • linear solenoid: no fault	• 250 ms • 2 times	• 2 DCY

AQ250 09G							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0725	Engine Speed Input Circuit	• CAN receive data check	• detection of error signal		• CAN bus: ACTIVE • ECU communication: ACTIVE • ECU data update: ACTIVE	• 250 ms	• 2 DCY
P0729	Gear 6 Incorrect Ratio	• Input and output rpm signal check. Separate error memory for each gear.	• comparison of indicated slip and actual slip with stored values	• 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1 s • 2. slip differences > (0.20 x current gear ratio x output revolutions) for more than 1 s	• engine speed > 400 rpm • output revolutions > 250 rpm • shift lever D or S • brake: OFF • slip difference of output speed (In case ABS valid) difference < 10% • revolution sensor, no back up condition • model oil temperature >= 0° C • common parameter, common condition (see footnote ⇒ page 165)	• 1 s • 12 times	• 2 DCY • cumulative

AQ250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0731	Gear 1 Incorrect Ratio	• Input and output rpm signal check. Separate error memory for each gear.	• comparison of indicated slip and actual slip with stored values	• ABS (input rev – output rev x other gear ratio) < (0.04 x other gear ratio x output rev) for more than 1 s	• engine speed > 400 rpm • output revolutions > 250 rpm • estimated engine torque > 100 Nm at 1st gear > 80 Nm at 1st EB gear • shift lever D or S • brake: OFF • slip difference of output speed and ABS difference < 10% (in case of ABS failure, this condition isn't activated) • engaged gear, 1st gear • revolution sensor, no back up condition • model oil temperature >= 20°C • common parameter, common condition (see footnote ⇒ page 165)	• 1 s • 12 times	• 2 DCY • cumulative

AQ250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• Neutral condition check	• detection of slip condition	• input revolutions > output revolutions x 1st gear ratio + 400 rpm for more than 3.3 s	• engine speed > 400 rpm • shift lever D or S • output revolutions <= 500 rpm • output revolutions which <= 500 rpm calculated from ABS (In case of ABS failure, this condition isn't activated) • L-up condition: OFF • input sensor, no back up condition • output sensor, active or back up by ABS • model oil temperature >= 0° C • common parameter, common condition (see footnote ⇒ page 165)	• 2 times	• 2 DCY • cumulative but, in case of changing the shift lever position, counter = 0

AQ250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0732	Gear 2 Incorrect Ratio	• Neutral condition check	• detection of slip condition	• input revolutions > output revolutions x 1st gear ratio + 400 rpm for more than 3.3 s	• engine speed > 400 rpm • shift lever D or S • output revolutions <= 500 rpm • output revolutions which <= 500 rpm calculated from ABS (In case of ABS failure, this condition isn't activated) • L-up condition: OFF • input sensor, no back up condition • output sensor, active or back up by ABS • model oil temperature >= 0° C • common parameter, common condition (see footnote ⇒ page 165)	• 2 times	• 2 DCY • cumulative but, in case of changing the shift lever position, counter = 0

AQ250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• Input and output rpm signal check. Separate error memory for each gear.	• comparison of indicated slip and actual slip with stored values	• 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1 s • 2. slip differences > (0.20 x current gear ratio x output revolutions) for more than 1 s	• engine speed > 400 rpm • output revolutions > 250 rpm • shift lever D or S • brake: OFF • slip difference of output speed (In case ABS valid) difference < 10% • revolution sensor, no back up condition • model oil temperature >= 0° C • common parameter, common condition (see footnote ⇒ page 165)	• 1 s • 12 times	• 2 DCY • cumulative

AQ250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0733	Gear 3 Incorrect Ratio	• Input and output rpm signal check. Separate error memory for each gear.	• comparison of indicated slip and actual slip with stored values	• 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1 s • 2. slip differences > (0.20 x current gear ratio x output revolutions) for more than 1 s	• engine speed > 400 rpm • output revolutions > 250 rpm • shift lever D or S • brake: OFF • slip difference of output speed (In case ABS valid) difference < 10% • revolution sensor, no back up condition • model oil temperature >= 0° C • common parameter, common condition (see footnote ⇒ page 165)	• 1 s • 12 times	• 2 DCY • cumulative

AQ250 09G							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0734	Gear 4 Incorrect Ratio	• Input and output rpm signal check. Separate error memory for each gear.	• comparison of indicated slip and actual slip with stored values	• 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1 s • 2. slip differences > (0.20 x current gear ratio x output revolutions) for more than 1 s	• engine speed > 400 rpm • output revolutions > 250 rpm • shift lever D or S • brake: OFF • slip difference of output speed (In case ABS valid) difference < 10% • revolution sensor, no back up condition • model oil temperature >= 0° C • common parameter, common condition (see footnote ⇒ page 165)	• 1 s • 12 times	• 2 DCY • cumulative

AQ250 09G							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0735	Gear 5 Incorrect Ratio	• Input and output rpm signal check. Separate error memory for each gear.	• comparison of indicated slip and actual slip with stored values	• 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1 s • 2. slip differences > (0.20 x current gear ratio x output revolutions) for more than 1 s	• engine speed > 400 rpm • output revolutions > 250 rpm • shift lever D or S • brake: OFF • slip difference of output speed (In case ABS valid) difference < 10% • revolution sensor, no back up condition • model oil temperature >= 0° C • common parameter, common condition (see footnote ⇒ page 165)	• 1 s • 12 times	• 2 DCY • cumulative
P0743	Torque Converter Clutch Circuit Electrical	• Input AD value check in every Linear solenoid.	• detection of wrong input AD value	• feedback current > 1333 mA (AD value > 1000) for more than 100 ms		• 100 ms • 5 times	• 2 DCY
				• feedback current < 23 mA (AD value < 15) for more than 100 ms	• main solenoid switch: ON		
		• Linear solenoid feedback current check	• comparison of target current and feedback current	• sum of difference of two current > 20000 Ω	• linear feedback current is > 23 mA (AD:15) < 1333 mA (AD:1000)	• 2 times	• 2 DCY • continuously

AQ250 09G							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0748	Pressure Control Solenoid "A" Electrical	• Input AD value check in every Linear solenoid.	• detection of wrong input AD value	• feedback current > 1333 mA (AD value > 1000) for more than 100 ms		• 100 ms • 5 times	• 2 DCY
				• feedback current < 23 mA (AD value < 15) for more than 100 ms	• main solenoid switch: ON		
		• Linear solenoid feedback current check	• comparison of target current and feedback current	• sum of difference of two current > 20000 Ω	• linear feedback current is > 23 mA (AD:15) < 1333 mA (AD:1000)	• 2 times	• 2 DCY • continuously
P0753	Shift Solenoid "A" Electrical	• Conduction check in ON/OFF solenoid.	• Comparison of the signal of solenoid monitor and solenoid driver output	• wrong output signal for more than 100 ms		• 100 ms • 5 times	• 2 DCY
P0798	Pressure Control Solenoid "C" Electrical	• Input AD value check in every Linear solenoid.	• detection of wrong input AD value	• feedback current > 1333 mA (AD value > 1000) for more than 100 ms		• 100 ms • 5 times	• 2 DCY
				• feedback current < 23 mA (AD value < 15) for more than 100 ms	• main solenoid switch: ON		
		• Linear solenoid feedback current check	• comparison of target current and feedback current	• sum of difference of two current > 20000 Ω	• linear feedback current is > 23 mA (AD:15) < 1333 mA (AD:1000)	• 2 times	• 2 DCY • continuously

AQ250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0811	Excessive Clutch "A" Slippage	• OFF stuck check.	• comparison of engine rpm and input rpm	• Engine rpm – input rpm > 100 rpm for 2 s	• engine speed > 400 rpm • shift lever D or S • engine speed < 4000 rpm • estimated engine torque >= 0 Nm • revolution sensor, no back up condition • SLU target current > 1000 mA • model oil temperature >= 20°C • common parameter, common condition (see footnote ⇒ page 165)	• 2 s • 6 times	• 2 DCY • continuously
P0864	TCM Communication Circuit Range/ Performance	• CAN communication check	• detection of communication error (all frames which are entered in ATCU)	• ECU no communication for more than 50 ms (In case of repeat rate is over 25 ms, double value of repeat rate is used)	• CAN bus: ACTIVE • time: 500 ms after ignition: ON	• 500 ms (In case of repeat rate is over 50 ms, 10 times value of repeat rate is used)	• 2 DCY

AQ250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			• detection of communication error (one frame which is entered in ATCU)	• ECU no communication for more than 50 ms (In case of repeat rate is over 25 ms, double value of repeat rate is used)	• CAN bus: ACTIVE • time: 500 ms after ignition: ON • ECU communication: not in no communication failure	• 1000 ms (In case of repeat rate is over 50 ms, 20 times value of repeat rate is used)	
		• CAN receive data check	• ECU signal data freeze (data counter (ID488, Byte8, Bit7…4) not updated)		• CAN bus: ACTIVE • CAN data repeat rate: the space of time between two received messages has not exceeded double the transmission cycle time	• no update in five message	
		• CAN communication check	• detection of communication error	• no acknowledge condition for more than 300 ms	• CAN bus: ACTIVE • time: 500 ms after ignition: ON	• 300 ms	
P0865	TCM Communication Circuit Low	• CAN communication check	• detection of communication error	• CAN BUS off condition for more than 250 ms	• time 500 ms after ignition: ON	• 250 ms	• 2 DCY
P2122	Throttle/ Pedal Position Sensor/ Switch "D" Circuit Low	• CAN communication check	• detection of error signal		• CAN bus: ACTIVE • ECU communication: ACTIVE • ECU data update: ACTIVE	• 250 ms	• 2 DCY

AQ250 09G							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P2637	Torque Management Feedback Signal "A"	• CAN receive data check for “signal invalid”	• detection of error signal (0xFF)		• CAN bus: ACTIVE • ECU communication: ACTIVE • ECU data update: ACTIVE	• 250 ms	• 2 DCY
P2716	Pressure Control Solenoid "D" Electrical	• Input AD value check in every Linear solenoid.	• detection of wrong input AD value	• feedback current > 1333 mA (AD value > 1000) for more than 100 ms		• 100 ms • 5 times	• 2 DCY
				• feedback current < 23 mA (AD value < 15) for more than 100 ms	• main solenoid switch: ON	• 100 ms • 5 times	• 2 DCY
		• Linear solenoid feedback current check	• comparison of target current and feedback current	• sum of difference of two current > 20000 Ω	• linear feedback current is > 23 mA (AD:15) < 1333 mA (AD:1000)	• 2 times	• 2 DCY • continuously
P2725	Pressure Control Solenoid "E" Electrical	• Input AD value check in every Linear solenoid.	• detection of wrong input AD value	• feedback current > 1333 mA (AD value > 1000) for more than 100 ms		• 100 ms • 5 times	• 2 DCY
				• feedback current < 23 mA (AD value < 15) for more than 100 ms	• main solenoid switch: ON	• 100 ms • 5 times	• 2 DCY
		• Linear solenoid feedback current check	• comparison of target current and feedback current	• sum of difference of two current > 20000 Ω	• linear feedback current is > 23 mA (AD:15) < 1333 mA (AD:1000)	• 2 times	• 2 DCY • continuously

AQ250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2734	Pressure Control Solenoid "F" Electrical	• Input AD value check in every Linear solenoid.	• detection of wrong input AD value	• feedback current > 1333 mA (AD value > 1000) for more than 100 ms		• 100 ms • 5 times	• 2 DCY
				• feedback current < 23 mA (AD value < 15) for more than 100 ms	• main solenoid switch: ON	• 100 ms • 5 times	• 2 DCY
		• Linear solenoid feedback current check	• comparison of target current and feedback current	• sum of difference of two current > 20000 Ω	• linear feedback current is > 23 mA (AD:15) < 1333 mA (AD:1000)	• 2 times	• 2 DCY • continuously

Footnote:

- main solenoid switch ON
- gear condition engaged
- S1 solenoid No fault
- linear solenoid no fault
- inhibitor switch no fault
- CAN communication no fault
- ECU data update no fault
- estimated engine torque no fault
- engine speed no fault
- accelerator pedal no fault
- T/M coding and MDI max info no fault
- ROM no fault
- RAM no fault
- safety processor no fault

3.6 Diagnostic Procedures

3.6.1 Fuel Pump Relay - J17- , Fuel Delivery Unit - GX1- Checking

This procedure is used to diagnose the Fuel Pump (FP) Relay - J17- . The Fuel Pump (FP) Relay - J17- is used to power the Fuel Delivery Unit - GX1- , which houses the Transfer Fuel Pump - G6- and Fuel Level Sensor - G- .

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring diagram.
- ♦ Scan tool.

Test requirements

- Fuses OK.

- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Coolant Temperature: ≥ 80 °C.
- Observe all safety precautions:
  ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions:
  ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 . – Was complaint verified?	◆ YES: ◆ GO TO Step 2 ⇒ page 167 . ◆ NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: ON • LISTEN: Transfer Fuel Pump - G6- Should be heard running for 2 s • SPECIFIED VALUE: Transfer Fuel Pump ON for 2 s • IGNITION: OFF – Was value obtained?	◆ YES: ◆ Condition may be intermittent ◆ PERFORM: Visual Inspection of wiring and component ◆ CHECK: wiring for open, high resistance, short or electrical connector for damage, corrosion, loose or broken terminals ◆ GO TO: Step 7 ⇒ page 169 ◆ NO: ◆ Go to Step 3 ⇒ page 167
3	• DISCONNECT: Transfer Fuel Pump - G6- . • CRANK: Engine • CHECK: Transfer Fuel Pump - G6- wiring connector terminals 1 to 5 for voltage while engine is cranking • IGNITION: OFF • SPECIFIED VALUE: 7 - 11 V – Was value obtained?	◆ YES: ◆ REPLACE: Transfer Fuel Pump - G6- . Refer to the appropriate repair manual. ◆ PERFORM: Road Test to verify repair. ◆ FAULT DOES NOT RETURN: ◆ GO TO: Step 7 ⇒ page 169 . ◆ NO: ◆ GO TO: Step 4 ⇒ page 168 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Fuel Pump Relay - J17- . Refer to the appropriate repair manual. • IGNITION: ON • CHECK: Fuel Pump Relay - J17- harness connector terminal 1 to ground for voltage. • CHECK: Fuel Pump Relay - J17- harness connector terminal 3 to ground for voltage. • SPECIFIED VALUE: 7 - 11 V – Were values obtained?	♦ YES: ♦ REPLACE: Fuel Pump Relay - J17- . Refer to the appropriate repair manual. ♦ PERFORM: Road Test to verify repair. ♦ FAULT DOES NOT RETURN: ♦ GO TO: Step 7 ⇒ page 169 . ♦ NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or electrical connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 168 .
5	• REMOVE: Fuel Pump Relay - J17- . Refer to the appropriate repair manual. • FOR 2011 - 2014 • CHECK: Fuel Pump Relay - J17- harness connector terminal 1 and 3 to Fuse 47 (On Fuse Panel C) - SC47- for resistance. • FOR 2015: • CHECK: Fuel Pump Relay - J17- harness connector terminal 3 to Fuse 47 (On Fuse Panel C) - SC47- for resistance. • CHECK: Fuel Pump Relay - J17- harness connector terminal 1 to Fuse 9 (On Fuse Panel B) - SB9- for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were values obtained?	♦ YES: ♦ REPLACE: Fuel Pump Relay - J17- . Refer to the appropriate repair manual. ♦ PERFORM: Road Test to verify repair. ♦ FAULT DOES NOT RETURN: ♦ GO TO: Step 7 ⇒ page 169 . ♦ NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or electrical connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 168 .
6	• REMOVE: Fuel Pump Relay - J17- . Refer to the appropriate repair manual. • CHECK: Fuel Pump Relay - J17- harness connector terminal 2 to Engine Control Module - J623- T94/ 93 for resistance. • CHECK: Fuel Pump Relay - J17- harness connector terminal 5 to Transfer Fuel Pump - G6- harness connector terminal 1 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were values obtained?	♦ YES: ♦ REPLACE: Fuel Pump Relay - J17- . Refer to the appropriate repair manual. ♦ PERFORM: Road Test to verify repair. ♦ FAULT DOES NOT RETURN: ♦ GO TO: Step 7 ⇒ page 169 . ♦ NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or electrical connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 7 ⇒ page 169 .

Step	Procedure	Result / Action to Take
7	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	♦ YES: ♦ Check the DTC memory. Refer to . ♦ Perform the diagnostic procedure for that DTC. ♦ NO: ♦ Repair is complete. Generate readiness code. Refer to . ♦ Return vehicle to Customer.

3.6.2 EVAP System, Checking for Leaks

Special tools and workshop equipment required

- ♦ Smoke tester.
- ♦ EVAP and Fuel Supply System Vacuum hose and line routing diagram.

Note

- ♦ *An connection to access the EVAP system can be found in the EVAP hose just below the EVAP purge solenoid.*
- ♦ *Replace seals and gaskets when performing repair work.*
- ♦ *Secure all hose connections using hose clamps appropriate for the model type.*

Leak checking

– Using a Smoke tester, check the Evaporative Emission (EVAP) canister system for leaks.

Note

Always follow the manufacturers directions for the proper installation and operation of the smoke tester being used.

If a leak is detected:

– Check the fuel filler cap seal for damage and for proper installation. Replace if necessary.

– Check all hose connections of the fuel supply system and replace or repair any leaking lines.

– Check all hose connections of the EVAP system and replace or repair any leaking lines.

– Check that the seal under the locking flange is properly tightened on the fuel tank.

– Repair or replace any damaged component.

If no leaks are found in the EVAP or Fuel Supply System:

– Erase the DTC memory if a DTC was set. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 16 .

– Perform a road test to verify repair.

If a DTC was set and does not return:

Generate readiness code. Refer to
⇒ “3.2 Readiness Code”, page 9 .

If the DTC does return and no leaks are found in the EVAP and Fuel Supply System:

– Check the DTC memory for any DTC codes pertaining to the EVAP and Fuel Supply Systems. If a DTC is stored, perform the diagnostic test procedure for the suspected component. Refer to
⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 .

3.6.3 EVAP Canister Purge Regulator Valve 1 - N80- , Checking

Function

EVAP system is designed so that the admission of fuel vapors takes place only at idle and at light part-throttle. The EVAP Canister Purge Regulator Valve 1 - N80- is map-activated by the Engine Control Module - J623- to accomplish this task.

Special tools and workshop equipment required

- Multimeter
- Wiring Diagram
- Scan Tool

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions:
⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions:
⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 . – Was Complaint verified?	♦ YES: ♦ GO TO Step 2 ⇒ page 171 . ♦ NO: ♦ GATHER more information from customer about the complaint.

Step	Procedure	Result / Action to Take
2	• IGNITION: OFF. • DISCONNECT: EVAP Canister Purge Regulator Valve 1 - N80- harness connector. • CHECK: EVAP Canister Purge Regulator Valve 1 - N80- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 10 – 20 Ω (@ approx. 20° C). – Was Value obtained?	♦ YES: ♦ GO TO: Step 3 ⇒ page 171 . ♦ NO: ♦ REPLACE: EVAP Canister Purge Regulator Valve 1 - N80- . Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 171 .
3	• IGNITION: ON. • CHECK: EVAP Canister Purge Regulator Valve 1 - N80- harness connector terminal 1 to ground for voltage. • SPECIFIED VALUE: Battery voltage. • IGNITION: OFF. – Was Value obtained?	♦ YES: ♦ GO TO: Step 4 ⇒ page 171 . ♦ NO: ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ REPLACE: Any open fuses. ♦ GO TO: Step 5 ⇒ page 171 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: EVAP Canister Purge Regulator Valve 1 - N80- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 32 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	♦ YES: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 171 . ♦ NO: ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 171 .
5	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	♦ YES: ♦ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 14 . ♦ Perform the diagnostic procedure for that DTC. ♦ NO: ♦ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 9 . ♦ Return vehicle to Customer.

3.6.4 Leak Detection Pump - V144- , Checking

Function

The Engine Control Module - J623- uses the Leak Detection Pump - V144- signal to calculate a correction value for the charge air pressure. Evaluation of the signal gives consideration to the influence of temperature on the density of the charge air.

Special tools and workshop equipment required

- ♦ Multimeter
- ♦ Wiring Diagram
- ♦ Scan Tool

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions:
  ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions:
  ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 . – Was Complaint verified?	♦ YES: ♦ GO TO Step 2 ⇒ page 172 . ♦ NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: ON. • DISCONNECT: Leak Detection Pump - V144- harness connector. • CHECK: Leak Detection Pump - V144- harness connector terminal 4 to ground for voltage. • SPECIFIED VALUE: Battery voltage. • IGNITION: OFF. – Was Value obtained?	♦ YES: ♦ GO TO Step 3 ⇒ page 172 . ♦ NO: ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ REPLACE: Any open fuses. ♦ GO TO: Step 5 ⇒ page 173 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Leak Detection Pump - V144- harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 28 for resistance. • CHECK: Leak Detection Pump - V144- harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / 25 for resistance. • CHECK: Leak Detection Pump - V144- harness connector terminal 3 to the Engine Control Module - J623- harness connector T94 / 9 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	♦ YES: ♦ GO TO: Step 4 ⇒ page 173 . ♦ NO: ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 173 .

Step	Procedure	Result / Action to Take
4	• CONNECT: Leak Detection Pump - V144- harness connector. • CHECK: Leak Detection Pump - V144- for operation. • CONNECT: Engine Control Module - J623- harness connector T94 / 28 to ground. • SPECIFIED VALUE: Leak Detection Pump - V144- should be heard running. – Was Value obtained?	♦ YES: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 173 . ♦ NO: ♦ REPLACE: Leak Detection Pump - V144- . Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 173 .
5	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	♦ YES: ♦ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 14 . ♦ Perform the diagnostic procedure for that DTC. ♦ NO: ♦ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 9 . ♦ Return vehicle to Customer.

3.6.5 Accelerator Pedal Module - GX2- , Checking

Function

The Accelerator Pedal Position Sensor - G79- and Accelerator Pedal Position Sensor 2 - G185- are combined in one component and integrated into the Accelerator Pedal Module - GX2- . They are used to detect the position of the accelerator pedal throughout the entire adjustment range. The Engine Control Module - J623- detects the driver's request from these signals and uses them to calculate the injection quantity and EPC Throttle valve operation.

The Accelerator Pedal Module - GX2- contains the following components:

♦ Accelerator Pedal Position Sensor - G79-

♦ Accelerator Pedal Position Sensor 2 - G185-

The Accelerator Pedal Module - GX2- components cannot be serviced separately, it must be serviced as a unit.

Special tools and workshop equipment required

♦ Multimeter

♦ Wiring Diagram

♦ Scan Tool

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF All electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".

- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions:
  ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions:
  ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 . – Was Complaint verified?	– YES: ◆ GO TO Step 2 ⇒ page 174 . – NO: ◆ GATHER more information from customer about the complaint.
2	• CONNECT: Scan Tool. • IGNITION: ON. • CHECK: Throttle valve position closed: • SPECIFIED VALUE: 3 – 25%. • DEPRESS: Accelerator pedal slowly to WOT while observing the percentage display. The percentage display must increase uniformly. • CHECK: Throttle valve position at WOT: • SPECIFIED VALUE: 84 – 97%. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ GO TO Step 3 ⇒ page 174 . – NO: ◆ GO TO Step 4 ⇒ page 174 .
3	• Condition may be intermittent. • PERFORM: Visual Inspection of wiring and component. • CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. • REPAIR: Faulty wiring or connector.	◆ GO TO: Step 6 ⇒ page 175 .
4	• DISCONNECT: Accelerator Pedal Module - GX2- harness connector. • IGNITION: ON. • CHECK: Accelerator Pedal Module - GX2- harness connector terminals 1 to 5 and 2 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Were Values obtained?	– YES: ◆ GO TO Step 5 ⇒ page 175 . – NO: ◆ GO TO Step 6 ⇒ page 175 .

Step	Procedure	Result / Action to Take
5	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 4 to the Engine Control Module - J623- harness connector T94 / 83 for resistance. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 6 to the Engine Control Module - J623- harness connector T94 / 61 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Accelerator Pedal Module - GX2- . Refer to appropriate repair manual. ◆ GO TO: Step 7 ⇒ page 175 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ⇒ page 175 .
6	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 81 for resistance. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / 82 for resistance. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 3 to the Engine Control Module - J623- harness connector T94 / 17 for resistance. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 5 to the Engine Control Module - J623- harness connector T94 / 11 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE Engine Control Module - J623- . Refer to appropriate repair manual. ◆ GO TO: Step 7 ⇒ page 175 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ⇒ page 175 .
7	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	– YES: ◆ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 14 . ◆ Perform the diagnostic procedure for that DTC. – NO: ◆ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 9 . ◆ Return vehicle to Customer.

3.6.6 Throttle Valve Control Module - J338 -, Checking

Function

Throttle valve operation occurs by an electric motor identified as Throttle Drive Motor located within the Throttle Valve Control Module - J338 - / Throttle Position Sensor - G69- . It is controlled by the Engine Control Module - J623- with primary inputs from the Accelerator Pedal Position Sensor - G79- / Accelerator Pedal Position Sensor 2 - G185- as well as other peripheral inputs from Throttle Position Sensor - G69- and Throttle Drive Motor.

The Throttle Valve Control Module - J338 - / Throttle Position Sensor - G69- components cannot be serviced separately, it must be serviced as a unit.

Special tools and workshop equipment required

- ♦ Multimeter
- ♦ Wiring Diagram
- ♦ Scan Tool

Test requirements

- Fuses OK.
- Battery voltage OK
- Switch OFF All electrical and electronic accessories
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Coolant Temperature: ≥ 80 °C.
- Observe all safety precautions:
  ⇒ “1.1 Safety Precautions”, page 2
- View clean working conditions:
  ⇒ “1.2 Clean Working Conditions”, page 4

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 – Was Complaint Verified?	– YES: ♦ Go to Step 2 ⇒ page 176 – NO: ♦ Gather more Information from customer about the complaint
2	• CONNECT: Scan Tool. • IGNITION: ON • CHECK: throttle valve position closed: • SPECIFIED VALUE: 3 - 25% • DEPRESS: Accelerator pedal slowly to WOT while observing the percentage display. The percentage display must increase uniformly • CHECK: throttle valve position at WOT: • SPECIFIED VALUE: 84 - 97% • IGNITION: OFF – Was value obtained?	– YES: ♦ Go to Step 3 ⇒ page 176 – NO: ♦ Go to Step 4 ⇒ page 177
3	• CONDITION: Intermittent • PERFORM: Visual Inspection of wiring and component • CHECK: wiring for open, high resistance, short or electrical connector for damage, corrosion, loose or broken terminals • REPAIR: faulty wiring or connector	♦ GO TO: Step 7 ⇒ page 177

Step	Procedure	Result / Action to Take
4	• DISCONNECT: Throttle Valve Control Module - J338 - harness connector • IGNITION: ON • CHECK: Throttle Valve Control Module - J338 - harness connector terminals 2 to 6 for voltage. • SPECIFIED VALUE: About 5 V • IGNITION: OFF – Was value obtained?	– YES: ◆ Go to Step 5 ⇒ page 177 – NO: ◆ Go to Step 6 ⇒ page 177
5	• REMOVE: Engine Control Module - J623- . Refer to appropriate service manual. • CHECK: Throttle Valve Control Module - J338 - harness connector terminals 1 to the Engine Control Module - J623- harness connector terminals T60 / 54 for resistance. • CHECK: Throttle Valve Control Module - J338 - harness connector terminals 4 to the Engine Control Module - J623- harness connector terminals T60 / 41 for resistance. • CHECK: Throttle Valve Control Module - J338 - harness connector terminals 3 to the Engine Control Module - J623- harness connector terminals T60 / 46 for resistance. • CHECK: Throttle Valve Control Module - J338 - harness connector terminals 5 to the Engine Control Module - J623- harness connector terminals T60 / 47 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω) – Was value obtained?	– YES: ◆ REPLACE: Throttle Valve Control Module - J338 - . Refer to appropriate repair manual. ◆ GO TO: Step 7 ⇒ page 177 – NO: ◆ CHECK: wiring for open, high resistance, short or electrical connector for damage, corrosion, loose or broken terminals ◆ REPAIR: faulty wiring or connector ◆ GO TO: Step 7 ⇒ page 177
6	• REMOVE: Engine Control Module - J623- . Refer to appropriate service manual. • CHECK: Throttle Valve Control Module - J338 - harness connector terminals 2 to the Engine Control Module - J623- harness connector terminals T60 / 12 for resistance. • CHECK: Throttle Valve Control Module - J338 - harness connector terminals 6 to the Engine Control Module - J623- harness connector terminals T60 / 43 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω) – Was value obtained?	– YES: ◆ REPLACE Engine Control Module - J623- Refer to appropriate repair manual ◆ GO TO: Step 7 ⇒ page 177 – NO: ◆ CHECK: wiring for open, high resistance, short or electrical connector for damage, corrosion, loose or broken terminals ◆ REPAIR: faulty wiring or connector ◆ GO TO: Step 7 ⇒ page 177
7	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	– YES: ◆ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 14 . ◆ Perform the diagnostic procedure for that DTC. – NO: ◆ Repair is complete, Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 9 . ◆ Return vehicle to Customer

3.6.7 Oxygen Sensor 1 Before Catalytic Converter - GX10- , Checking

Function

The Oxygen Sensor 1 Before Catalytic Converter - GX10- does not actually measure oxygen concentration, but rather the difference between the amount of oxygen in the exhaust gas and the amount of oxygen in air. Rich mixture causes an oxygen demand. This demand causes a voltage to build up, due to transportation of oxygen ions through the Heated Oxygen Sensor - G39- layer. Lean mixture causes low voltage, since there is an oxygen excess. The Oxygen Sensor 1 Before Catalytic Converter - GX10- and catalytic converters are used in order to reduce exhaust emissions. Information on oxygen concentration is sent to Engine Control Module - J623- , which adjusts the amount of fuel injected into the engine to compensate for excess air or excess fuel. The Engine Control Module - J623- attempts to maintain, on average, a certain air–fuel ratio by interpreting the information it gains from the Heated Oxygen Sensor - G39- . The primary goal is a compromise between power, fuel economy, and emissions. The Oxygen Sensor Heater - Z19- is designed to minimize the time-to-readiness for closed-loop operation by heating the Heated Oxygen Sensor - G39- as quickly as possible.

The Oxygen Sensor 1 Before Catalytic Converter - GX10- contains the following components:

- Oxygen Sensor Heater - Z19-
- and
- Heated Oxygen Sensor - G39-

The Oxygen Sensor 1 Before Catalytic Converter - GX10- components cannot be serviced separately, it must be serviced as a unit.

Special tools and workshop equipment required

- Multimeter
- Wiring Diagram
- Scan Tool

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions:
  ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions:
  ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 . – Was Complaint verified?	– YES: ◆ GO TO Step 2 ⇒ page 179 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- component connector terminals 3 to 4 for resistance. • SPECIFIED VALUE: 2 - 5 Ω (@ 25° C). – Was Value obtained?	– YES: ◆ GO TO Step 3 ⇒ page 179 . – NO: ◆ REPLACE: Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to appropriate repair manual. ◆ GO TO: Step 9 ⇒ page 180 .
3	• IGNITION: ON. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector terminal 4 to ground for voltage. • SPECIFIED VALUE: Battery voltage. • IGNITION: OFF. – Were Values obtained?	– YES: ◆ GO TO Step 5 ⇒ page 179 . – NO: ◆ GO TO Step 4 ⇒ page 179 .
4	• PERFORM: Visual Inspection of wiring and component. • CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. • REPAIR: Faulty wiring or connector. • REPLACE: Any open fuses.	◆ GO TO: Step 9 ⇒ page 180 .
5	• RECONNECT: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector. • CONNECT: Scan Tool. • START: Engine and let Idle. • Perform the function test located in diagnostic mode 06. Refer to appropriate Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, ⇒ “3.3 Diagnostic Modes 01 - 09”, page 11 . • SPECIFIED VALUE: Mode 6 Pass. • IGNITION: OFF. – Were Values obtained?	– YES: ◆ GO TO Step 6 ⇒ page 179 . – NO: ◆ GO TO Step 7 ⇒ page 180 .
6	• FAULT: Is intermittent. • PERFORM: Visual Inspection of wiring and component. • CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. • REPAIR: Faulty wiring or connector.	◆ GO TO: Step 9 ⇒ page 180 .

Step	Procedure	Result / Action to Take
7	• DISCONNECT: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector. • START: Engine and let Idle. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- component connector terminals 5 to 6 for voltage. • SPECIFIED VALUE: 0.0 V to 1.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ GO TO: Step 8 ⇒ page 180 . – NO: ◆ REPLACE: Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to appropriate repair manual. ◆ GO TO: Step 9 ⇒ page 180 .
8	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector terminal 5 to the Engine Control Module - J623- harness connector T94 / 56 for resistance. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector terminal 6 to the Engine Control Module - J623- harness connector T94 / 57 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ GO TO: Step 9 ⇒ page 180 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 9 ⇒ page 180 .
9	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	– YES: ◆ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 14 . ◆ Perform the diagnostic procedure for that DTC. – NO: ◆ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 9 . ◆ Return vehicle to Customer.

3.6.8 Oxygen Sensor 1 After Catalytic Converter - GX7- , Checking

Function

The Oxygen Sensor 1 After Catalytic Converter - GX7- downstream of the primary catalytic converter supplies the Engine Control Module - J623- with a voltage signal (nonlinear) indicating "rich" or "lean. If the primary catalytic converter is supersaturated with oxygen (lean mixture), Oxygen Sensor 1 After Catalytic Converter - GX7- will send the Engine Control Module - J623- a nonlinear signal indicating the lean mixture condition. The mixture is then enriched with fuel until the oxygen has been "displaced" from the catalytic converter. This condition, in turn, is registered by Oxygen Sensor 1 After Catalytic Converter - GX7- as a nonlinear signal indicating the rich mixture condition. The mixture is then leaned out by the Engine Control Module - J623- . If the nonlinear signal is received again, the mixture will again be enriched. The frequency, or period, during which the mixture is enriched or leaned out is variable, being dependent on the gas flow rate (engine load) at that moment.

The Oxygen Sensor 1 After Catalytic Converter - GX7- contains the following components:

- The Heater For Oxygen Sensor 1 After Catalytic Converter - Z29-
- Oxygen Sensor After Three Way Catalytic Converter - G130-

The Oxygen Sensor 1 After Catalytic Converter - GX7- components cannot be serviced separately, it must be serviced as a unit.

Special tools and workshop equipment required

- Multimeter
- Wiring Diagram
- Scan Tool

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions:
  ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions:
  ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 . – Was Complaint verified?	♦ YES: ♦ GO TO Step 2 ⇒ page 181 . ♦ NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- component connector terminal 1 to 2 for resistance. • SPECIFIED VALUE: 2 - 4 Ω (@ 25° C). – Was Value obtained?	♦ YES: ♦ GO TO Step 3 ⇒ page 181 . ♦ NO: ♦ REPLACE: Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to appropriate repair manual. ♦ GO TO: Step 9 ⇒ page 183 .
3	• IGNITION: ON. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	♦ YES: ♦ GO TO Step 5 ⇒ page 182 . ♦ NO: ♦ GO TO Step 4 ⇒ page 182 .

Step	Procedure	Result / Action to Take
4	• PERFORM: Visual Inspection of wiring and component. • CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. • REPAIR: Faulty wiring or connector. • REPLACE: Any open fuses.	♦ GO TO: Step 9 ⇒ page 183 .
5	• RECONNECT: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector. • CONNECT: Scan Tool. • START: Engine and let Idle. • Perform the function test located in diagnostic mode 06. Refer to appropriate Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, ⇒ “3.3 Diagnostic Modes 01 - 09”, page 11 . • SPECIFIED VALUE: Mode 6 Pass. • IGNITION: OFF. – Were Values obtained?	♦ YES: ♦ GO TO Step 6 ⇒ page 182 . ♦ NO: ♦ GO TO Step 7 ⇒ page 182 .
6	• FAULT: Is intermittent. • PERFORM: Visual Inspection of wiring and component. • CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. • REPAIR: Faulty wiring or connector.	♦ GO TO: Step 9 ⇒ page 183 .
7	• DISCONNECT: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector. • START: Engine and let Idle. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- component connector terminals 3 to 4 for voltage. • SPECIFIED VALUE: 0.0 V to 1.0 V. • IGNITION: OFF. – Was Value obtained?	♦ YES: ♦ GO TO: Step 8 ⇒ page 182 . ♦ NO: ♦ REPLACE: Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to appropriate repair manual. ♦ GO TO: Step 9 ⇒ page 183 .
8	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector terminal 3 to the Engine Control Module - J623- harness connector T94 / 72 for resistance. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector terminal 4 to the Engine Control Module - J623- harness connector T94 / 84 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	♦ YES: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ GO TO: Step 9 ⇒ page 183 . ♦ NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 9 ⇒ page 183 .

Step	Procedure	Result / Action to Take
9	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	♦ YES: ♦ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 14 . ♦ Perform the diagnostic procedure for that DTC. ♦ NO: ♦ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 9 . ♦ Return vehicle to Customer.

3.6.9 Intake Air Temperature Sensor - G42- / Manifold Absolute Pressure Sensor - G71- , Checking

Function

Air mass and charge pressure are two factors used for engine load management. For this purpose, there are several sensors with absolutely identical functions. They measure the intake air temperature and the intake manifold pressure. The first sender unit is located upstream of the throttle valve control module J338 and contains the following senders:

- ♦ – Intake Air Temperature Sensor - G42- .
- ♦ – Manifold Absolute Pressure Sensor - G71- .

They measure the pressure and temperature of the air in each individual cylinder bank. The values measured here correspond to the actual air mass in the cylinder bank(s).

Special tools and workshop equipment required

- ♦ Multimeter
- ♦ Wiring Diagram
- ♦ Scan Tool

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 . – Was Complaint verified?	♦ YES: ♦ GO TO Step 2 ⇒ page 184 . ♦ NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: ON. • DISCONNECT: Intake Air Temperature Sensor - G42- / Manifold Absolute Pressure Sensor - G71- harness connector. • CHECK: Intake Air Temperature Sensor - G42- / Manifold Absolute Pressure Sensor - G71- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	♦ YES: ♦ GO TO Step 3 ⇒ page 184 . ♦ NO: ♦ GO TO Step 4 ⇒ page 184 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Intake Air Temperature Sensor - G42- / Manifold Absolute Pressure Sensor - G71- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 42 for resistance. • CHECK: Intake Air Temperature Sensor - G42- / Manifold Absolute Pressure Sensor - G71- harness connector terminal 4 to the Engine Control Module - J623- harness connector T60 / 56 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω) – Were Values obtained?	♦ YES: ♦ REPLACE: Intake Air Temperature Sensor - G42- / Manifold Absolute Pressure Sensor - G71- . Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 185 . ♦ NO: ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 185 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Intake Air Temperature Sensor - G42- / Manifold Absolute Pressure Sensor - G71- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 13 for resistance. • CHECK: Intake Air Temperature Sensor - G42- / Manifold Absolute Pressure Sensor - G71- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 44 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	♦ YES: ♦ REPLACE Engine Control Module - J623- Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 185 . ♦ NO: ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 185 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	♦ YES: ♦ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 14 . ♦ Perform the diagnostic procedure for that DTC. ♦ NO: ♦ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 9 . ♦ Return vehicle to Customer.

3.6.10 Engine Coolant Temperature Sensor - G62- , Checking

Function

The Engine Coolant Temperature Sensor - G62- sends information about the current coolant temperature to the Engine Control Module - J623- . It uses the coolant temperature as a correction value for calculating the injection quantity.

Special tools and workshop equipment required

- ♦ Multimeter
- ♦ Wiring Diagram
- ♦ Scan Tool

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Manual Transmission, ensure Gear Shift Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ "3.1 Preliminary Check", page 9 . – Was Complaint verified?	– YES: ♦ GO TO Step 2 ⇒ page 186 . – NO: ♦ GATHER more information from customer about the complaint.

Step	Procedure	Result / Action to Take
2	• IGNITION: OFF. • DISCONNECT: Engine Coolant Temperature Sensor - G62- harness connector. • CHECK: Engine Coolant Temperature Sensor - G62- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 925 Ω (+/- 500 Ω @ approx. 20° C). • IGNITION: OFF. – Was Value obtained?	– YES: ♦ GO TO Step 3 ⇒ page 186 . – NO: ♦ REPLACE: Engine Coolant Temperature Sensor - G62- . Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 186 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Engine Coolant Temperature Sensor - G62- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 57 for resistance. • CHECK: Engine Coolant Temperature Sensor - G62- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 14 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 186 . – NO: ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 186 .
4	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	– YES: ♦ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 14 . ♦ Perform the diagnostic procedure for that DTC. – NO: ♦ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 9 . ♦ Return vehicle to Customer.

3.6.11 Engine Coolant Temperature Sensor On Radiator Outlet - G83- , Checking

Function

The Engine Coolant Temperature Sensor On Radiator Outlet - G83- sends information about the current coolant temperature to the Engine Control Module - J623- . It uses the coolant temperature as a correction value for calculating the injection quantity.

Special tools and workshop equipment required

♦ Multimeter

♦ Wiring Diagram

♦ Scan Tool

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.

- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions:
  ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions:
  ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 . – Was Complaint verified?	– YES: ◆ GO TO Step 2 ⇒ page 187 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Engine Coolant Temperature Sensor On Radiator Outlet - G83- harness connector. • CHECK: Engine Coolant Temperature Sensor On Radiator Outlet - G83- harness connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 4000 Ω (+/- 500 Ω @ approx. 20° C). – Was Value obtained?	– YES: ◆ GO TO Step 3 ⇒ page 187 . – NO: ◆ REPLACE: Engine Coolant Temperature Sensor On Radiator Outlet - G83- . Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 187 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Engine Coolant Temperature Sensor On Radiator Outlet - G83- harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 18 for resistance. • CHECK: Engine Coolant Temperature Sensor On Radiator Outlet - G83- harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / 12 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 187 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 187 .
4	• Final Procedure • Perform a road test to verify repair. • Do any DTC’s return:	– YES: ◆ Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 . ◆ Perform the diagnostic procedure for that DTC. – NO: ◆ Repair is complete. Generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 9 . ◆ Return vehicle to Customer.

3.6.12 Engine Speed Sensor - G28- , Checking

Function

The Engine Speed Sensor - G28- detects rpm and reference marks from a toothed wheel on the crankshaft. Without an engine

speed signal, the engine will not start. If the engine speed signal fails while the engine is running, the engine will stop immediately.

Special tools and workshop equipment required

- ♦ Multimeter
- ♦ Wiring Diagram
- ♦ Scan Tool

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Manual Transmission, ensure Gear Shift Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions:
  ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions:
  ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 . – Was Complaint verified?	– YES: ♦ GO TO Step 2 ⇒ page 188 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Engine Speed Sensor - G28- harness connector. • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Engine Speed Sensor - G28- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 40 for resistance. • CHECK: Engine Speed Sensor - G28- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 52 for resistance. • CHECK: Engine Speed Sensor - G28- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 51 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REMOVE: Engine Speed Sensor - G28- . Refer to appropriate repair manual. ♦ CHECK: Engine Speed Sensor - G28- wheel for proper seating, damage and/or run - out. Refer to appropriate repair manual. ♦ Sensor wheel OK. ♦ REPLACE: Engine Speed Sensor - G28- . Refer to appropriate repair manual. ♦ GO TO: Step 3 ⇒ page 189 . – NO: ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 3 ⇒ page 189 .

Step	Procedure	Result / Action to Take
3	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	– YES: ◆ FAULT DOES RETURN: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ FAULT DOES NOT RETURN: ◆ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 14 . ◆ Perform the diagnostic procedure for that DTC. – NO: ◆ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 9 . ◆ Return vehicle to Customer.

3.6.13 Cylinder 1 – 4 Fuel Injectors , Checking

Includes:

Cylinder 1 Fuel Injector - N30-

Cylinder 2 Fuel Injector - N31-

Cylinder 3 Fuel Injector - N32-

Cylinder 4 Fuel Injector - N33-

Function

The Cylinder Fuel Injectors are controlled by the Engine Control Module - J623- and mounted normal in the cylinder head. The fuel injectors spray high-pressure atomized fuel directly into the combustion chamber.

Special tools and workshop equipment required

- ◆ Multimeter
- ◆ Wiring Diagram
- ◆ Scan Tool
- ◆ LED Test Lamp

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 . – Was Complaint verified?	– YES: ♦ GO TO Step 2 ⇒ page 190 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Faulty Fuel Injector from harness connector. • CHECK: The faulty Fuel Injector component connector terminals for resistance. (Refer to the appropriate wiring diagram for proper terminal locations). • SPECIFIED VALUE: 11 – 15 Ω (@ approx. 20° C). – Was value obtained?	– YES: ♦ GO TO Step 3 ⇒ page 190 . – NO: ♦ REPLACE: Faulty injector(s). Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 190 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate service manual. • CHECK: Faulty Fuel Injector harness connector terminals to the Engine Control Module - J623- harness connector terminals. (Refer to the wiring diagram for proper terminal locations). • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 190 . – NO: ♦ CHECK: wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 190 .
4	• Final Procedure • Perform a road test to verify repair. • Do any DTC’s return:	– YES: ♦ Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 . ♦ Perform the diagnostic procedure for that DTC. – NO: ♦ Repair is complete. Generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 9 . ♦ Return vehicle to Customer.

3.6.14 Motronic Engine Control Module Power Supply Relay - J271- , Checking

Function

The following procedure is used to diagnose the Motronic Engine Control Module Power Supply Relay - J271- and the Engine Control Module - J623- power supply voltage that is provided by the Motronic Engine Control Module Power Supply Relay - J271- .

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions:
⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions:
⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 191 . – NO: ◆ GATHER more information from customer about the complaint.
2	• DISCONNECT: Motronic Engine Control Module Power Supply Relay - J271- from the SB Fuse box in the engine compartment. • CHECK: Motronic Engine Control Module Power Supply Relay - J271- socket terminal 30 to ground for voltage. • CHECK: Motronic Engine Control Module Power Supply Relay - J271- socket terminal 86 to ground for voltage. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 191 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring, SB fusebox or connector. ◆ REPLACE: Any open fuses. ◆ GO TO: Step 6 ⇒ page 192 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CONNECT: Jumper wire, Motronic Engine Control Module Power Supply Relay - J271- socket terminals 30 and 87. • CHECK: Engine Control Module - J623- harness connector T94 / 3 and 5 to ground for voltage. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 192 . – NO: ◆ GO TO: Step 5 ⇒ page 192 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Jumper wire, Motronic Engine Control Module Power Supply Relay - J271- socket terminals 30 and 87. • CHECK: Motronic Engine Control Module Power Supply Relay - J271- socket terminal 85 to the Engine Control Module - J623- harness connector T94 / 69 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ REPLACE: Motronic Engine Control Module Power Supply Relay - J271- . Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 192 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ REPLACE: Any open fuses. ♦ GO TO: Step 6 ⇒ page 192 .
5	• REMOVE: Jumper wire, Motronic Engine Control Module Power Supply Relay - J271- socket terminals 30 and 87. • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • REMOVE: Fuse 2 (On Fuse Panel B) - SB2- . Refer to appropriate repair manual. • CHECK: Downstream (output) side of Fuse 2 (On Fuse Panel B) - SB2- to Engine Control Module - J623- harness connector T94 / 3 and 5 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Fuse Panel B - SB- fuse box. Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 192 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ REPLACE: Any open fuses. ♦ GO TO: Step 6 ⇒ page 192 .
6	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	– YES: ♦ FAULT DOES RETURN: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ FAULT DOES NOT RETURN: ♦ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 14 . ♦ Perform the diagnostic procedure for that DTC. – NO: ♦ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 9 . ♦ Return vehicle to Customer.

3.6.15 Vehicle Speed Signal, Checking

Function

The Vehicle Speed Signal or VSS measures Transmission / Transaxle output or Wheel Speed from the ABS System. The signal is broadcasted over the CAN Bus. The Engine Control Module - J623- uses this information to modify engine functions such as

ignition timing, A/F ratio, transmission shift points, and to initiate diagnostic routines.

Special tools and workshop equipment required

- ♦ Multimeter
- ♦ Wiring Diagram
- ♦ Scan Tool

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions:
  ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions:
  ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 . – Was Complaint verified?	– YES: ♦ GO TO Step 2 ⇒ page 193 . – NO: ♦ GATHER more information from customer about the complaint.
2	• CONNECT: Scan Tool. • ROAD TEST: Vehicle. • CHECK: Scan Tool to Speedometer for accuracy. • SPECIFIED VALUE: Difference ≤ 10%. – Was Value obtained?	– YES: ♦ CONDITION: May be intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO Step 4 ⇒ page 194 . – NO: ♦ GO TO Step 3 ⇒ page 193 .
3	• CHECK: ABS system. • CHECK: ABS DTC’s. – Was the ABS system OK?	– YES: ♦ CHECK: CAN Bus wiring from Instrument Cluster Control Module - J285- to ABS Control Module - J104- . ♦ GO TO Step 4 ⇒ page 194 . – NO: ♦ REPAIR: Any ABS concerns 1st. ♦ GO TO Step 4 ⇒ page 194 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	– YES: ◆ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 14 . ◆ Perform the diagnostic procedure for that DTC. – NO: ◆ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 9 . ◆ Return vehicle to Customer.

3.6.16 Three Way Catalytic Converter, TWC Checking

Function

A catalytic converter is a vehicle emissions control device that converts toxic pollutants in exhaust gas to less toxic pollutants by catalyzing a redox reaction (oxidation or reduction). Catalytic converters are used in internal combustion engines.

General recommendations

Observe all safety precautions:
⇒ "1.1 Safety Precautions", page 2 .

View clean working conditions:
⇒ "1.2 Clean Working Conditions", page 4 .

Prior to repair work, perform a preliminary check to verify the condition. Refer to ⇒ "3.1 Preliminary Check", page 9 .

Test requirements

- Battery voltage at least 12.5 volts.
- Oxygen sensors OK.
- No leaks or damage to exhaust system.

Function test

Step	Procedure	Result / Action to Take
1	Activate Monitors: • Perform the function test in Diagnostic Mode 06. Refer to ⇒ "3.3 Diagnostic Modes 01 - 09", page 11 . • End diagnosis and switch the ignition off. • If the specified values are exceeded:	◆ Check the exhaust system for leaks. ◆ If necessary, repair the leak(s) in the exhaust system. ◆ GO TO Step 2 ⇒ page 194 .
2	O2 Sensor Monitoring: • Erase the DTC memory. Refer to ⇒ "3.3.4 Diagnostic Mode 04 - Erase DTC Memory", page 16 . • Perform a road test to verify repair. • If the DTC does not return:	◆ Generate readiness code. Refer to . ◆ If no leaks are found in the exhaust system: ◆ Replace the catalytic converter with front exhaust pipe. Refer to the appropriate repair manual. ◆ GO TO Step 3 ⇒ page 195 .

Step	Procedure	Result / Action to Take
3	• Final procedure: • Perform a road test to verify repair.	• After the repair work, the following work steps must be performed in the following sequence: • Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 - Read DTC Memory”, page 14 . • If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 - Erase DTC Memory”, page 16 . • If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 9 . • Return vehicle to Customer.

3.6.17 Camshaft Position Sensor - G40- , Checking

Function

Using the signal from the Camshaft Position Sensor - G40- , the precise position of the camshaft relative to the crankshaft is determined very quickly when the engine is started. Used in combination with the signal from the Engine Speed Sensor - G28- , the signal from the Camshaft Position Sensor - G40- allows to detect which cylinder is at TDC. The fuel can be injected into the corresponding cylinder and ignited.

Special tools and workshop equipment required

- ♦ Multimeter
- ♦ Wiring Diagram
- ♦ Scan Tool

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 . – Was Complaint verified?	– YES: ♦ GO TO Step 2 ⇒ page 196 . – NO: ♦ GATHER more information from customer about the complaint.

Step	Procedure	Result / Action to Take
2	• DISCONNECT: Camshaft Position Sensor - G40- harness connector. • IGNITION: ON. • CHECK: Camshaft Position Sensor - G40- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ GO TO Step 3 ⇒ page 196 . – NO: ◆ GO TO Step 4 ⇒ page 196 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Camshaft Position Sensor - G40- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 6 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Camshaft Position Sensor - G40- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 196 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 196 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Camshaft Position Sensor - G40- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 44 for resistance. • CHECK: Camshaft Position Sensor - G40- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 40 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 196 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 196 .
5	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	– YES: ◆ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 14 . ◆ Perform the diagnostic procedure for that DTC. – NO: ◆ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 9 . ◆ Return vehicle to Customer.

3.6.18 Knock Sensor 1 - G61- , Checking

Function

The Knock Sensor 1 - G61- is a tuned accelerometer on the engine which converts engine vibration to an electrical signal. The Engine Control Module - J623- uses this signal to determine the presence of engine knock and to retard spark timing.

Special tools and workshop equipment required

◆ Multimeter

- ♦ Wiring Diagram
- ♦ Scan Tool

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions:
  ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions:
  ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 . – Was Complaint verified?	♦ YES: ♦ GO TO Step 2 ⇒ page 197 . ♦ NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Knock Sensor 1 - G61- harness connector. • CHECK: Knock Sensor 1 - G61- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: ∞ 4800 Ω (+/- 500 Ω). – Was Value obtained?	♦ YES: ♦ GO TO Step 3 ⇒ page 197 . ♦ NO: ♦ REPLACE: Knock Sensor 1 - G61- . Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 198 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Knock Sensor 1 - G61- harness connector terminals 1 to the Engine Control Module - J623- harness connector T60 / 8 for resistance. • CHECK: Knock Sensor 1 - G61- harness connector terminals 2 to the Engine Control Module - J623- harness connector T60 / 9 for resistance. • CHECK: Knock Sensor 1 - G61- harness connector terminals 3 to the Engine Control Module - J623- harness connector T60 / 40 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	♦ YES: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 198 . ♦ NO: ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 198 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	♦ YES: ♦ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 14 . ♦ Perform the diagnostic procedure for that DTC. ♦ NO: ♦ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 9 . ♦ Return vehicle to Customer.

3.6.19 Ignition Coil - N152- , Checking

Function

The ignition coil must transform the relatively low 12 V on-board vehicle voltage to the high ignition voltage required and supply the energy stored in that voltage to the spark plug. The functional principle of the ignition coil is relatively simple. It has a primary winding (small number of turns) and a secondary winding (lots of turns). The turn ratio between the number of primary and secondary winding turns determines the level of the voltage generated at the output. Ignition Coil - N152- are plugged directly into the spark plug. This means that the ignition energy can be transferred directly to the spark plug with virtually zero power loss.

Special tools and workshop equipment required

- ♦ Multimeter
- ♦ Wiring Diagram
- ♦ Scan Tool
- ♦ LED Test Lamp

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 . – Was Complaint verified?	♦ YES: ♦ GO TO Step 2 ⇒ page 199 . ♦ NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: ON. • DISCONNECT: Ignition Coil - N152- harness connector. • CHECK: Ignition Coil - N152- harness connector terminals 2 to 4 for voltage. • SPECIFIED VALUE: Battery voltage. • IGNITION: OFF. – Was Value obtained?	♦ YES: ♦ GO TO Step 3 ⇒ page 199 . ♦ NO: ♦ CHECK: Wiring for opens, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ REPLACE: Any open fuses. ♦ GO TO: Step 5 ⇒ page 200 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Faulty Ignition Coil - N152- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 50 for resistance. • CHECK: Faulty Ignition Coil - N152- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 35 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	♦ YES: ♦ GO TO: Step 4 ⇒ page 199 . ♦ NO: ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 200 .
4	• DISCONNECT: All of the Fuel Injectors . Refer to appropriate wiring diagram. • DISCONNECT: Cold Start Injector (If applicable). • CONNECT: Engine Control Module - J623- harness connector. • CONNECT: LED Test Lamp to Faulty Ignition Coil - N152- harness connector terminals 1 to 2 or 2 and 3. • CRANK: Engine. • SPECIFIED VALUE: LED Test Lamp should Flicker ON & OFF. – Was Value obtained?	♦ YES: ♦ REPLACE: Faulty Ignition Coil - N152- . Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 200 . ♦ NO: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 200 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	♦ YES: ♦ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 14 . ♦ Perform the diagnostic procedure for that DTC. ♦ NO: ♦ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 9 . ♦ Return vehicle to Customer.

3.6.20 CAN-Bus Terminal Resistance, Checking

Function

The Engine Control Module - J623- communicates with other CAN-Bus capable control modules.

The control modules are connected by two data bus wires which are twisted together (CAN_High and CAN_Low), and exchange information (messages). Missing information on the CAN-bus is recognized as a malfunction by the Engine Control Module - J623- and the other control modules connected to the CAN-bus.

Trouble-free operation of the CAN-Bus requires that it have a terminal resistance. This central terminal resistance is located in the Engine Control Module - J623- .

Special tools and workshop equipment required

♦ Multimeter

♦ Wiring Diagram

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in "P".
- Vehicles with Man. Transmission, ensure Shifter Lever position is in "N" with Parking Brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to . – Was Complaint verified?	– YES: ♦ GO TO Step 2 ⇒ page 201 . – NO: ♦ GATHER more information from customer about the complaint.

Step	Procedure	Result / Action to Take
2	• DISCONNECT: Data Bus On Board Diagnostic Interface - J533- harness connector. • The Engine Control Module - J623- must remain connected for the following step. • CHECK: Data Bus On Board Diagnostic Interface - J533- harness connector terminals T20 / 6 to T20 / 16 for resistance. • Specified value: 60 to 72 Ω (at approx. 20° C). – Was Value obtained?	– YES: ◆ CONDITION: May be intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO Step 4 ⇒ page 201 . – NO: ◆ GO TO Step 3 ⇒ page 201 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Faulty Data Bus On Board Diagnostic Interface - J533- harness connector terminal T20 / 6 to the Engine Control Module - J623- harness connector T94 / 67 for resistance. • CHECK: Faulty Data Bus On Board Diagnostic Interface - J533- harness connector terminal T20 / 16 to the Engine Control Module - J623- harness connector T94 / 68 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ GO TO Step 4 ⇒ page 201 . – NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ If no malfunction is found in the wiring: ◆ REPLACE: Data Bus On Board Diagnostic Interface - J533- . Refer to appropriate repair manual. ◆ GO TO Step 4 ⇒ page 201 .
4	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	– YES: ◆ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 14 . ◆ Perform the diagnostic procedure for that DTC. – NO: ◆ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 9 . ◆ Return vehicle to Customer.

3.6.21 CAN-Bus Terminal Resistance, Transmission Control Module - J217- to Engine Control Module - J623- , Checking

Function

The Engine Control Module - J623- communicates with all databus capable control modules via a CAN databus.

These databus capable control modules are connected via two data bus wires which are twisted together (CAN_High and CAN_Low), and exchange information (messages). Missing information on the databus is recognized as a malfunction and stored.

Trouble-free operation of the CAN-bus requires that it have a terminal resistance. The central terminal resistor is located in the Engine Control Module - J623- .

Special tools and workshop equipment required

- ♦ Multimeter
- ♦ Wiring Diagram

Test requirements

- A CAN malfunction was recognized
- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with Auto. Transmission, ensure Selector Lever position is in “P”.
- Vehicles with Man. Transmission, ensure Shifter Lever position is in “N” with Parking Brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 9 . – Was Complaint verified?	♦ YES: ♦ GO TO Step 2 ⇒ page 202 . ♦ NO: ♦ GATHER more information from customer about the complaint.
2	• REMOVE: Transmission Control Module - J217- . Refer to appropriate repair manual. • DISCONNECT: Transmission Control Module - J217- harness connector. • CHECK: Harness connector for damage, corrosion, loose, or broken terminals. • REPAIR: As necessary. – Do any DTC’s return:	♦ YES: ♦ GO TO: Step 3 ⇒ page 202 . ♦ NO: ♦ GO TO: Step 5 ⇒ page 203 .
3	• The Engine Control Module - J623- must remain connected for the following step. The central terminal resistor is located in the Engine Control Module - J623- . • CHECK: Transmission Control Module - J217- harness connector T52 / 34 to 46 for resistance. • Specified value: 60 to 72 Ω (at approx. 20° C). – Was Value obtained?	♦ YES: ♦ CONDITION: May be intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 203 . ♦ NO: ♦ GO TO: Step 4 ⇒ page 203 .

Step	Procedure	Result / Action to Take
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: CAN bus circuit between the Transmission Control Module - J217- harness connector T52 / 34 and the Engine Control Module - J623- harness connector T94 / 67 for resistance. • CHECK: CAN bus circuit between the Transmission Control Module - J217- harness connector T52 / 46 and the Engine Control Module - J623- harness connector T94 / 68 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	◆ YES: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 203 . ◆ NO: ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 203 .
5	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	◆ YES: ◆ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 - Read DTC Memory", page 14 . ◆ Perform the diagnostic procedure for that DTC. ◆ NO: ◆ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 9 . ◆ Return vehicle to Customer.

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Cautions & Warnings

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work. You must answer that you have read and you understand these WARNINGS and CAUTIONS before you will be allowed to view this information.

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Volkswagen retailer or other qualified shop. We especially urge you to consult an authorized Volkswagen retailer before beginning repairs on any vehicle that may still be covered wholly or in part by any of the extensive warranties issued by Volkswagen.

- Disconnect the battery negative terminal (ground strap) whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.

- Volkswagen is constantly improving its vehicles and sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, part numbers listed in this manual are for reference only. Always check with your authorized Volkswagen retailer parts department for the latest information.

- Any time the battery has been disconnected on an automatic transmission vehicle, it will be necessary to reestablish Transmission Control Module (TCM) basic settings using the VAG 1551 Scan Tool (ST).

- Never work under a lifted vehicle unless it is solidly supported on stands designed for the purpose. Do not support a vehicle on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a vehicle that is supported solely by a jack. Never work under the vehicle while the engine is running.

- For vehicles equipped with an anti-theft radio, be sure of the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered when the power is restored, the radio may lock up and become inoperable, even if the correct code is used in a later attempt.

- If you are going to work under a vehicle on the ground, make sure that the ground is level. Block the wheels to keep the vehicle from rolling. Disconnect the battery negative terminal (ground strap) to prevent others from starting the vehicle while you are under it.

- Do not attempt to work on your vehicle if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medicine or any other substances that may impair you or keep you from being fully alert.

- Never run the engine unless the work area is well ventilated. Carbon monoxide (CO) kills.

- Always observe good workshop practices. Wear goggles when you operate machine tools or work with acid. Wear goggles, gloves and other protective clothing whenever the job requires working with harmful substances.

- Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.

- Do not re-use any fasteners that are worn or deformed in normal use. Some fasteners are designed to be used only once and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual - replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.

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Cautions & Warnings

- Illuminate the work area adequately but safely. Use a portable safety light for working inside or under the vehicle. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

- Friction materials such as brake pads and clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.

- Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.

- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly; do not attempt shortcuts. Use tools that are appropriate to the work and use only replacement parts meeting Volkswagen specifications. Makeshift tools, parts and procedures will not make good repairs.

- Catch draining fuel, oil or brake fluid in suitable containers. Do not use empty food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.

- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque listed.

- Keep sparks, lighted matches, and open flame away from the top of the battery. If escaping hydrogen gas is ignited, it will ignite gas trapped in the cells and cause the battery to explode.

- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.

- The air-conditioning (A/C) system is filled with a chemical refrigerant that is hazardous. The A/C system should be serviced only by trained automotive service technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.

- Before doing any electrical welding on vehicles equipped with anti-lock brakes (ABS), disconnect the battery negative terminal (ground strap) and the ABS control module connector.

- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.

- When boost-charging the battery, first remove the fuses for the Engine Control Module (ECM), the Transmission Control Module (TCM), the ABS control module, and the trip computer. In cases where one or more of these components is not separately fused, disconnect the control module connector(s).

- Some of the vehicles covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is operated by an explosive device. Handled improperly or without adequate safeguards, it can be accidentally activated and cause serious personal injury. To guard against personal injury or airbag system failure, only trained Volkswagen Service technicians should test, disassemble or service the airbag system.

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Cautions & Warnings

- Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.
- Never use a test light to conduct electrical tests of the airbag system. The system must only be tested by trained Volkswagen Service technicians using the VAG 1551 Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the vehicle.
- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.
- When driving or riding in an airbag-equipped vehicle, never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.

I have read and I understand these Cautions and Warnings.

back OK